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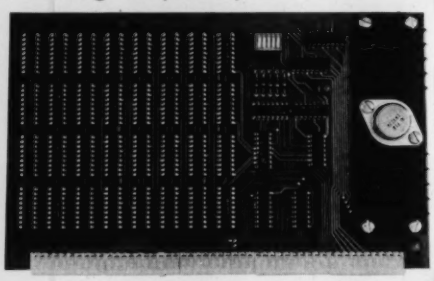

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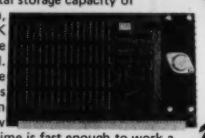

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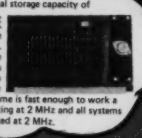

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In This Issue

articles

14 **Winter Consumer Electronics Show** ..... Craig
The latest prototypes and production items

34 **Elements of a Good Computer Game** ..... Friedman
Chance, strategy, or action

38 **Aesthetics: Is Your Computer Missing Out?** ... Endress
Build a pretty home for your computer

44 **Making Friends With That Home Computer** ..... Mecca
For Women Only

106 **I Can Steal Your Computer** ..... Gluck
Safeguarding Your Investment

108 **People Programming** ..... Garson
Correcting user errors at run time

116 **Marin Computer Center** ..... Fox
A "New Age" Learning Environment

124 **Interpretive Programming** ..... Whaland
Assembly language techniques

132 **Computerized Motoring** ..... Hallen
Is Your Car Ready For This?

evaluations & profiles

49 **Compleat Computer Catalogue** .....
Twenty-four pages of new products

120 **Checker Challenger** ..... Ahl
A competent electronic partner

122 **Wow! How'd All That Stuff Get In There?** ..... Barry
A data base for personal use

135 **Checkbook Maintenance System** ..... Brooks
From Computerware Software Services

137 **Video Checkers** ..... Churchman
From Compu-Quote

April 1979, Volume 5, Number 4

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fiction & foolishness

37 **Computer Myths Explained** ..... Wolverton
Computerized Unemployment

92 **Predictive Documentation By Computer** ..... Denning
This paper wasn't written yet

93 **Dial-A-Consultant** .....

applications - games

74 **Music Composition** ..... Altmayer
A different approach

86 **A Roman's Assignment Problem** ..... Anderson
Matching groups of objects

94 **Puzzles & Problems** ..... Townsend
Merlin comes to our pages

98 **Superose** ..... Zorn
Flowers for your PET

100 **What Will Happen If?** ..... Lappan & Winter
How many packs of bubble gum to get all the cards?

128 **An Intelligent Calendar** ..... Young
Help for remembering important dates

146 **Vertical Graphs and Bar Charts** ..... Barrett

departments

8 **Input/Output** .....
Letters to Creative, feedback from us

12 **Editorial** ..... Craig

22 **Apple Cart** ..... Milewski
Apple disk exec, The Apple Corps.

24 **TRS-80 Strings** ..... Gray
Library 100, CLOAD T-Shirt, Microwave

28 **Personal Electronic Transactions** ..... Yob
The PET Clock and Files

72 **Notices** .....

142 **Book Reviews** ..... Gray
One of these eight may be for you

The Cover .....
Lorraine Mecca working at her computer. See article on page 44.

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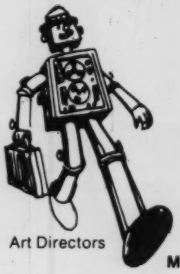

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4-Year Cumulative Index to Creative Computing and ROM

Yes, folks, *Creative Computing* has been around for four (count them, 4) years! Our first issue was Nov/Dec 1974 and Vol. 4, No. 6 was Nov/Dec 1978. For those of you with all those issues around it's sometimes difficult to remember just when that neat article on Magic Squares appeared, or which four issues carried the CAI Series of articles, or in which issues we reviewed all 34 books on BASIC.

Also, not to overlook our cousin ROM, we've included all the meaty articles, programs, reviews and other information from that periodical too.

We've cross-referenced articles that have appeared in both *Creative Computing* magazine and the *Best of Creative Computing Vols. 1 and 2*, hence, the current source of every article is listed.

Articles are classified by subject area and listed by title and author. Over 2000 separate items are included. The index does not include a cross-reference to author.

The index was put together by Jane Fletcher on a DECsystem-10 using the text editor and runoff (with a Diablo 1620).

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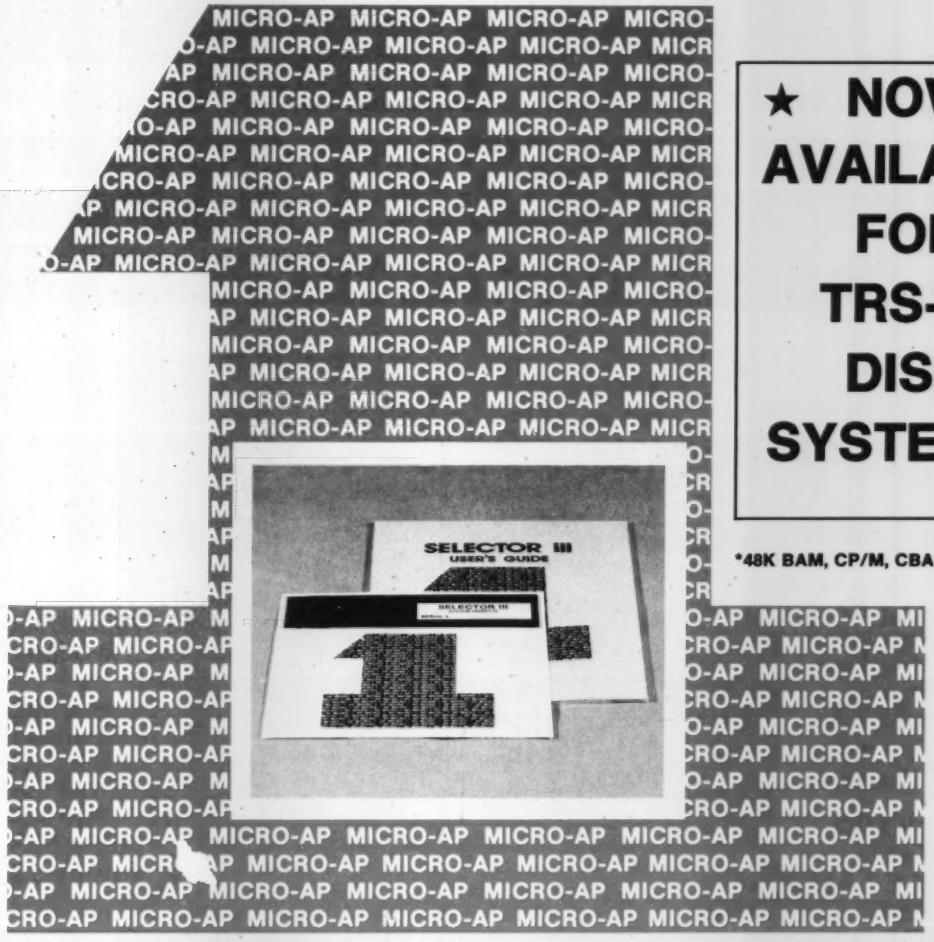

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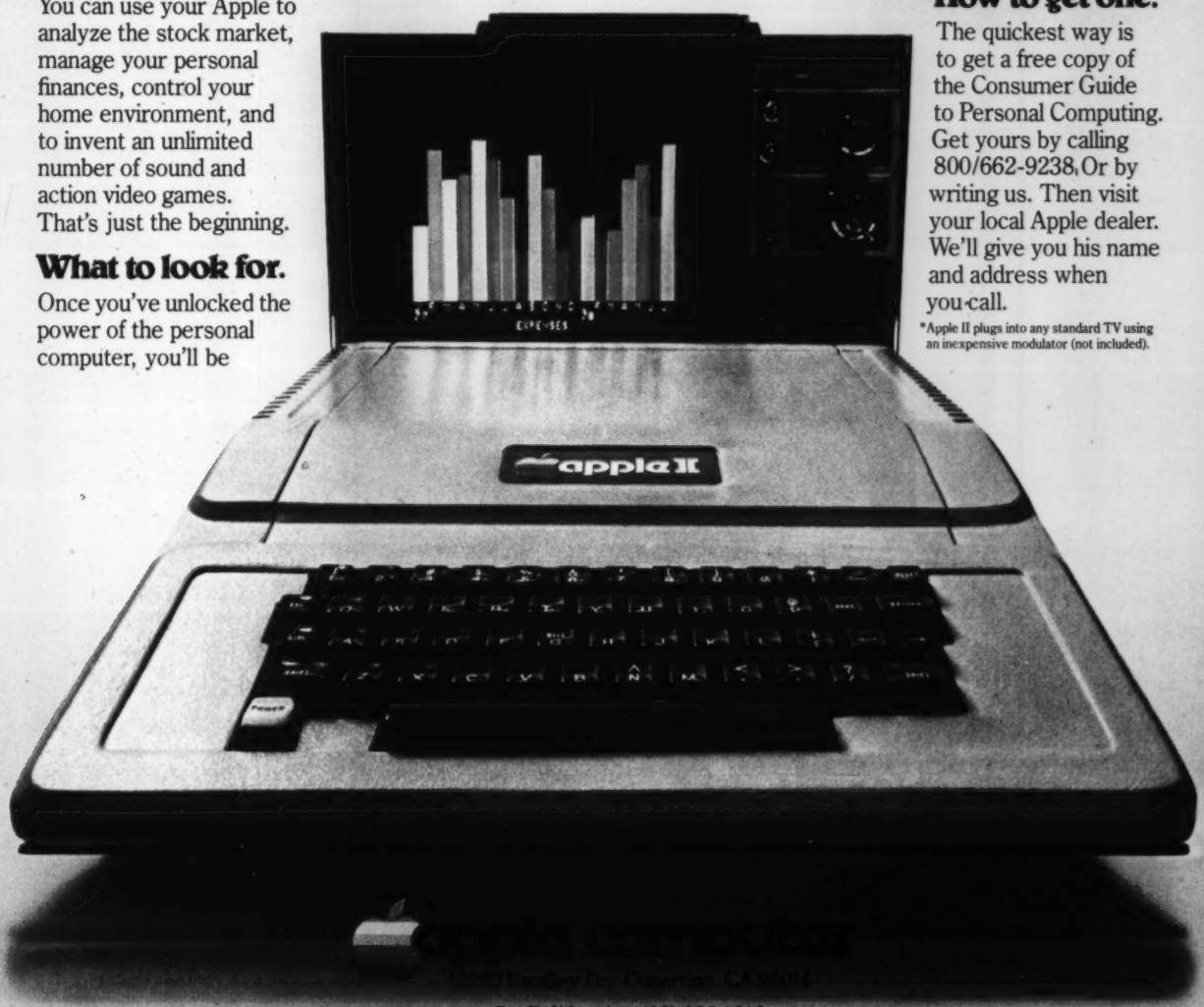

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Input Output

Embarrassing

Dear Editor:

I have just finished the first reading of your January issue, which, according to the cover is "Vol. 5, No. 1." I enjoyed the issue but was surprised to see this same issue referred to as "Volume 5, Number 6" on the index page. I found myself on the index page looking in vain for something advertised on the cover as "Pascal's triangle." I found it neither on the index page nor in the magazine. May I also point out that your index says that something called "You're Another" should appear on page 122. I failed to find it.

Keep the quality high, but don't lose your credibility!

Robert L. Doran
Director of Data Processing

Once in a while we suffer "disasters" and the person responsible suffers termination (employment, that is).—John

Beyond BASIC?

Dear Editor:

Dr. Douglas Hogg has done an excellent job in his outline of Fortran. I know Basic well and have just started taking a class in Fortran. Even though I don't have a computer of my own, I was able to get a good overview of Fortran.

I was going to let my subscription expire but when I saw Creative Computing expanding into other areas, I decided to renew. Why not publish one or two programs in other languages? All your articles are good but Basic can get old.

Jeff Anderson

The Number Game

Dear Editor:

Having been interested in statistics for some time I always give a table of numbers the close scrutiny. The Creative Computing number (p. 128, Jan '79 issue) is certainly the most interesting number I have seen to date. Having that most important data base at hand some rigorous statistical analysis yields the following:

1. Creative Computing's standard deviation is high.
2. The mean is well above average.
3. The Total Number is consistent from month to month.
4. Creative Computing is normally distributed by mail.
5. Circulation will reach a bundle by 1982.
6. If one spills tomato soup on the reader service card he should write the manufacturers direct.
7. Creative Computing is positively correlated.
8. Creative Computing is not a stationary process.
9. Creative Computing has slight random variations.

These results were based on the assumption of a 95% confidence level using other magazines as a standard. Calculations were done by a staff of 46 on a lightning fast Side-Zipper-21.

Rob Cave
1711 Plymouth Drive
Irving, Texas 75061

COSMAC/Startrek

Dear Editor:

I am a 15 year old boy who is very interested in computers and computer programming. I have written this letter in request for information on the following subjects:

First of all, I own an RCA COSMAC ELF II mini-computer and would like to know if there is any way to attach an 8-track tape player to the ELF II for a source of RAM. I have 4K of RAM and am planning to buy more. I was thinking that there might be some way to use the continuous loop tape player instead of the cassette player.

Secondly, I am a STARTREK program freak and would like to get some info or some listings for various STARTREK games. My school district owns and operates an HP-2000E Time-Share computer. If there are any other people who have access to an HP-2000 series computer who would like to share programs or other information could you ask them to write me? I am also pretty good at translating programs for different computers. Also, I am a serious programmer but have run out of ideas for new programs. I am frequently going through our school's public programs and rewriting to work better and take up shorter space.

And lastly, I am looking for games which are made up of two or more chained programs or can be made into two or more chained programs. In our public library (computer library, that is) we have a STARTREK program that is for 2-4 players on separate terminals. Do you know if this program is a popular program? The name of the program is TREK4T and is made up of about 26 chained programs.

P.S. (Can you recommend any good books on the 1802 microprocessor and/or the ELF II computer?)

Thank you.

Scott Taylor
331 Metz Rd.
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Monterey, Calif. 93941

One of the best publications I've seen for 1802 owners is a newsletter called IPSO FACTO. It's published by Tom Crawford, 50 Brentwood Dr., Stoney Creek, Ontario, Canada L8G 2W8. Unfortunately, I don't know what the subscription rate is.—JTC

Sorcerer Feedback

Dear Editor:

I would like to make some comments on Ken Barbier's article on the Exidy Sorceror in the January issue of Creative Computing.

First off, as Mr. Barbier has probably noticed, though they claim that there are 128 user definable graphic characters there is one drawback. The 64 predefined characters don't stay user defined. When a "clear" character is encountered (either in a PRINT statement of just typing it as input or something) these 64 characters go back to their original designs. Now, this shouldn't happen at all; but as long as it does the manual

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CIRCLE 200 ON READER SERVICE CARD

should at least mention it in passing. Also, the manuals are fine to beginners of BASIC, but they should have another manual for the Z80 machine language.

I suppose you've noticed that the graphic characters also have to be in quotes in REM statements, marring the beauty of some of them. The double precision, PRINT USING, and AUTO functions I can live without, though you are right about the almost non-negotiable EDIT subfunctions. Some which you failed to point out are: the lack of a RENumber command (very useful, though hard to implement), a command to get keyboard responses without an input statement (GET and INKEY$ in the PET and TRS-80, respectively (I think), and finally, something that has always made me mad about the Microsoft BASIC, the fact that the only kind of LIST's you can get are the entire program, and from line X to the end of the program. Whatever happened to being able to list single lines, and any portion of the program? I, for one, don't want to keep my fingers on the CTRL and C keys while the LISTing flashes by.

As for the Shift Lock key, I had no problems with it. They must have fixed this defect by the time they got around to my computer (No. 705). Oh, is THAT what the control O function is supposed to do? There was no documentation about it. I found out something interesting about it, though. If you type a line like 10 PRINT"HI(ctrl/O) THERE(ctrl/O)STORY", the line will look like 10 PRINT"HISTORY", but when LISTed, will come out 10 PRINT"HI. Why is this? Incidentally, I've never seen a computer which documents the USR function well, if at all. I don't think the writers are too sure what it does themselves. Do you happen to know the monitor commands for looking at the registers and altering breakpoints are? I figured that there must be something, but couldn't figure out how to do it.

Michael Turniansky

Michael turniansky does make some valid points in his letter. I expecially valued his comments about the user definable graphics, as our sorcerer is a working computer and I haven't had time to experiment too much with the more enjoyable aspects of its features.

The Z80 machine language manual he feels is missing is not really missing, it is an optional product, the Development pac. Exidy felt, and I think rightly, that most users would not need this facility, so it is offered as an option.

We are still satisfied with our Sorcerer, and hope Michael and other buyers of the Sorcerer feel the same.

Ken Barbier

Final Word On Sexism

Dear Editor:

This letter was prompted by your well done put down of the sexist charge in your January issue.

I think your magazine is excellent. The sexist charge was out of line to any but the most fanatic feminists.

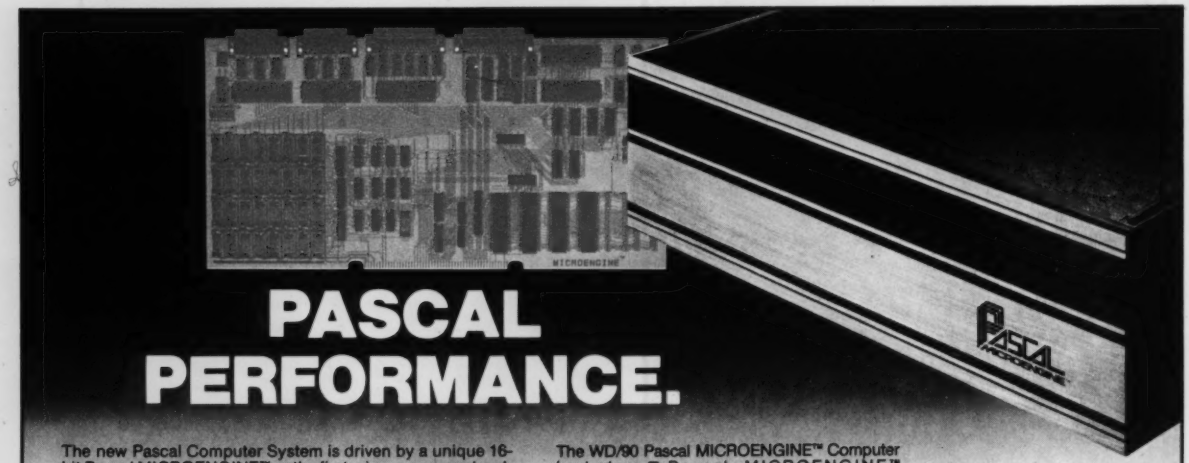
Having twenty years in the computer field, qualifies me with a reasonable amount of experience. Date Processing was one of the first fields of employment, to not only recognize, but encourage women. This is exemplified in large and small installations.

Keep up the good work in your magazine. Creative Computing is a well written, diversified publication, enjoyed by professionals and amateurs alike.

Margo Adam
Vice President
Micro-Services, Inc.
Seabury Road
York, Maine 03909

I was afraid I might have been too rough on Linda Malone, the lady who wrote the letter, but apparently I wasn't. She responded to my reply with another letter saying that perhaps she had been a little carried away with the moment... plus, she extended her subscription for another year! Now we're all good friends... and moving on to more positive aspects of computing (in a Creative way).

John.



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CIRCLE 189 ON READER SERVICE CARD

Fortran-80 Rematch With LSI-11

Dear Editor:

Read with interest the article in January Creative Computing concerning Microsoft FORTRAN-80. I am writng to comment on two items:

1) Lower case error messages are much more readable than strictly upper case info. Perhaps the terminal manufacturer could supply a conversion for him. My Heath H9 required two jumpers and 15 minutes for the conversion to map lower case to upper case.

2) I must question the author's comparison of FORTRAN-80 with the FORTRAN on the LSI-11(DEC). Why did he compare the INTEGER programs on the two machines? Wouldn't a more valid comparison of speed be real numbers, or double precision numbers, in order to compare 16 vs 8 bits, or simply instructions sets? Since the memory accesses have been cut in half on the DEC, you would expect it to be at least twice as fast in the Integer programs (leaving speed considerations aside). The basic cycle time of the LSI-11 is 380-400 ns, and can be increased to approximately 330 ns if the KEV-11 arithmetic chip is used, slightly faster otherwise. The resulting speeds are 2.6 or 3.0 MHz. I ran the same benchmarks on a LSI-11 with the clock at 3 MHz, with the following results:

Benchmark	FORTRAN 80 (I)	FORTRAN 80 (R)	DEC(I)	DEC(R)
1	.033		.022	.022
2	.057	2.9	.040	.19
3	2.0	9.0	.19	.63
4	2.0	10.6	.19	.60
5	2.0	10.7	.38	.79
6	2.1	10.8	.51	.92
7	2.2	11.0	.53	.98

If you consider the speed difference, the LSI-11 is twice as fast in the Integer mode, and at least five times faster in the Real mode. I would be interested in the times for FORTRAN 80 doing real calculations, as compared to the simple arithmetic that BENCH 1-7 contains.

Jim Krugh
6459 Phillips Ave.
Pittsburgh, PA 15217

Help For Level II Basic

Dear Editor:

I have a TRS-80, Level II, 1y K Ram, and I am one of the mass consumer market which would probably never have been induced to try a computer if it had not been offered by a retailer like Radio Shack.

I hope that everyone in a similar position is fortunate enough to discover your magazine, which I find most useful, informative and educational and without which I probably would not be enjoying my TRS-80. (I am not a "computer" person. I am a lawyer, judge and Radio Shackaholic). You will have my subscription when you complete the conversion to monthly issues.

Suggestion: Elimination of fiction and foolishness would be no loss. Addition of a column for answering reader's questions would no doubt benefit many readers.

Question: I try all of the programs appearing in CC and find that those which contain a "DEF FN" line will not work, no doubt because, as explained in the Level II manual, "DEF FN" is in Level II Disk Basic only, which I cannot justify purchasing. Can you or any of your readers tell me if there is an alternative or alternatives to "DEF FN", which will do the same thing and is available in the Level II without Disk Basic.

If there are alternatives, I doubt that I will ever understand programming well enough to discover them. Therefore, any suggestions will be greatly appreciated.

Thank you.

Russell G. Sheley
4045 W. Country Gables Dr.
Phoenix, Arizona 85023

DEF FN is a shorthand method of writing expressions. When the function is "invoked" later in the program, the computer plugs in your previous definition. If your BASIC doesn't have user-defined functions, just write out the expression in place of the function call. If the function definition includes a "dummy argument" then you substitute the correct actual expression. Example:

original program	*conversion*
*10 DEF FNF(X)=SIN(X)+5*Y*	*10 REM*
100 PRINT FNF(A+B)	*100 PRINT SIN(A+B)+5*Y*

Notice that we just copied the definition of the function in place of FNF(A+B) and substituted (A+B) for (X) in the definition. — Steve North

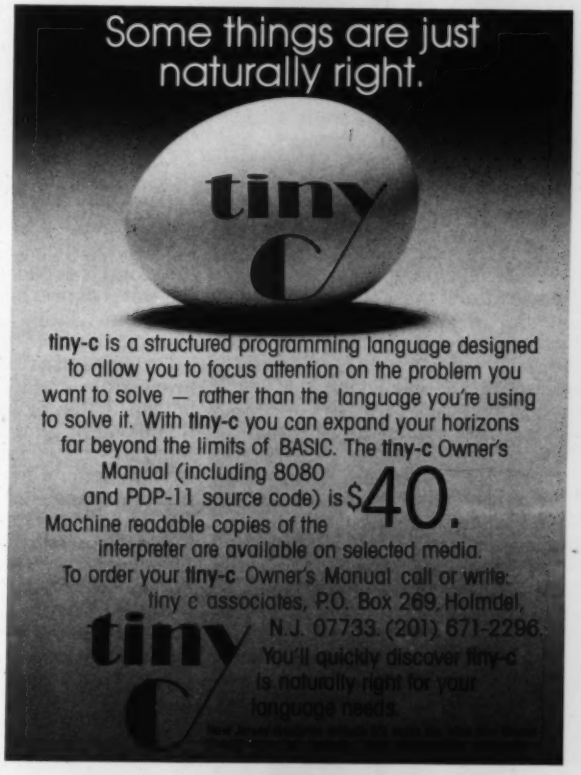
Octal Code Conversion

Dear Editor:

The code conversion table on page 35 of Feb. 1979 issue is incorrect. Since octal numbers are composed of the digits 0 through 7, it isn't possible to have an octal number with an 8 or a 9 in it. The number that follows octal 77 is octal 100 (the code for the ASCII character "@"). Next come 101, 102, 103, . . . and the table should end with octal 177 (the code for "DEL").

To find the reverse-video codes for the SOL, one should add 128 to the decimal code, but that is 200 octal, not 160.

Andrew Behrens
Swanee Bean Road
Thetford Center, Vermont 05075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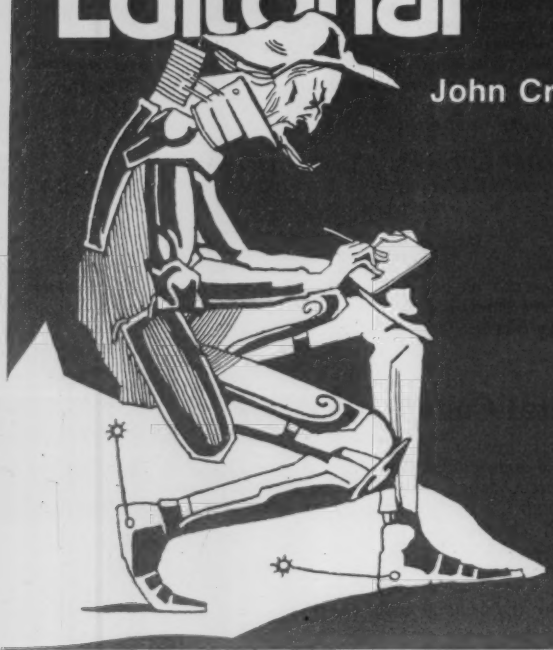
Editorial

John Craig



"I can't write a magazine article!"

Is that something you've said to yourself at one time or another? It's a statement I hear occasionally. Too many people who could sit down at a typewriter and pound out an article have convinced themselves they can't. If you're one of those people, then read on ... and maybe I can convince you otherwise!

Why do you suppose some people write articles? Well, one of the reasons is the feeling of accomplishment it provides. Sometimes it can be a fairly difficult undertaking, especially the first few times you do it. Seeing the finished work published, along with your byline, in a magazine that's going to be read by tens of thousands of people more than makes up for the effort. Let's face it ... it's somewhat of an ego trip, and there's nothing wrong with that at all. Another reason for writing articles is the money. Aha, now we get to the good part, right? Not necessarily. People don't get rich writing magazine articles (for any magazine) and it's not the way to earn a full-time income. Many of Creative Computing's writers are involved in computers as a hobby, one way or the other, and their writing falls in the same category. It's part-time income and definitely a good way to pick up extra cash for memory expansion, peripherals and other things. Our payment policy is equal to any of the other personal computing magazines and we pay upon acceptance, rather than publication. But ... there are times when exceptional material comes along, in which case we pay exceptionally well. We're committed to bringing the best possible magazine to our readers and rewards to our writers.

Another good reason many people sit down at the ol' typewriter and bang out an article is because of a genuine desire to share their experiences with others. "Reinventing the wheel" is getting to be a worn-out cliche but it's a definite consideration in the personal computing field. A lot of writers have found that the fact they've published professionally looks quite good in a resume, college entrance application and similar situations. (Heck, I once had an author applying for the NASA astronaut program and he wanted to know the publication dates of some upcoming articles so he could include them on his application. I don't know if that writing gave him the extra edge ... but I do know that he's now an astronaut!)

I'm sure that some people have shied away from trying to write articles because they're afraid of looking ridiculous in print. That is not something to worry about. if you come up with something bad I'm not going to publish it because it will make Creative Computing (and me) look bad! Usually a little rework will take care of anything. The main thing is for you to give it a try. Tell you what ... we just finished up one of the best author's guides you'll ever see and if you'll drop me a line, I'll be happy to send you a copy (along with the latest "Articles Hot List"). You look that guide over and see just how easy this whole thing can be. ■

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LAS VEGAS CONVENTION CENTER

WELCOME 1979 INTERNATIONAL WINTER CONSUMER ELECTRONICS SHOW

Come along and I'll show you around one of the biggest and most exciting conventions of the year. For those of you who have never been to Las Vegas, I'm only sorry I can't take you on a tour of the city, also! (Actually, I'd like to give the tour just so I can go back!) The 1979 Winter Consumer Electronics Show was held in Las Vegas in January of this year. It is, without a doubt, the biggest show of its kind. I suspect some of the "showmanship" of the city is responsible for the razzle-dazzle found at the convention. One thing's for sure . . . it was there.

Surprisingly, there was only one other magazine from the personal computing field at the show. I don't know what this indicates about the magazines who weren't there but it was only natural that we were. The consumer market is where this whole thing is heading and, as a result, Creative Computing is going in that direction. One of the best things about this Winter's Consumer Electronics Show was the large number of consumer computers and microprocessor products making a showing. 1979 is going to be the year . . . look out!

Texas Instruments was expected to introduce their home computer system but apparently it's not going to be ready for our examination until the Consumer Electronics Show in Chicago in June. We're all anxiously waiting, TI! One of the most interesting individuals I met at the show was Joe Jefferson, who is in Marketing Strategy for Personal Computers at TI . . . which is something I discovered through our vast, underground network. (There's no way Joe would have divulged that information . . . even under torture!) I swear they must have training sessions which teach their people how to hold

conversations with magazine editors and not say anything! Although I couldn't get Joe to even accidentally spill anything, he didn't have any qualms about asking me questions on anything and everything. I sure would love to sneak into their development labs!

I hope you enjoy these new computers and products as much as I did. Stay tuned to Creative Computing for reviews of them in upcoming issues. (And remind me sometime to tell you about Las Vegas!)

Apple had an impressive display but, more importantly, some impressive people to answer questions. Trip Hawkins, their Manager of Market Planning (shown demonstrating the Apple for Leonard Marcus, Editor-In-Chief of High Fidelity magazine), was typical of the consumer-oriented staff . . . answering questions from newcomers and providing them with good analogies when explaining things. Steve Jobs, one of the company's founders and now VP of New Product Development, came up with a very interesting and revealing comment. He said that Apple Computer now buys more floppy disk drives from Shugart than anyone else in the world. Send for a copy of their new magazine and catalog (Apple) which features "Computers in Education" in the first issue ($2). Apple Computer Inc., 10260 Bandley Dr., Cupertino, CA 95014.

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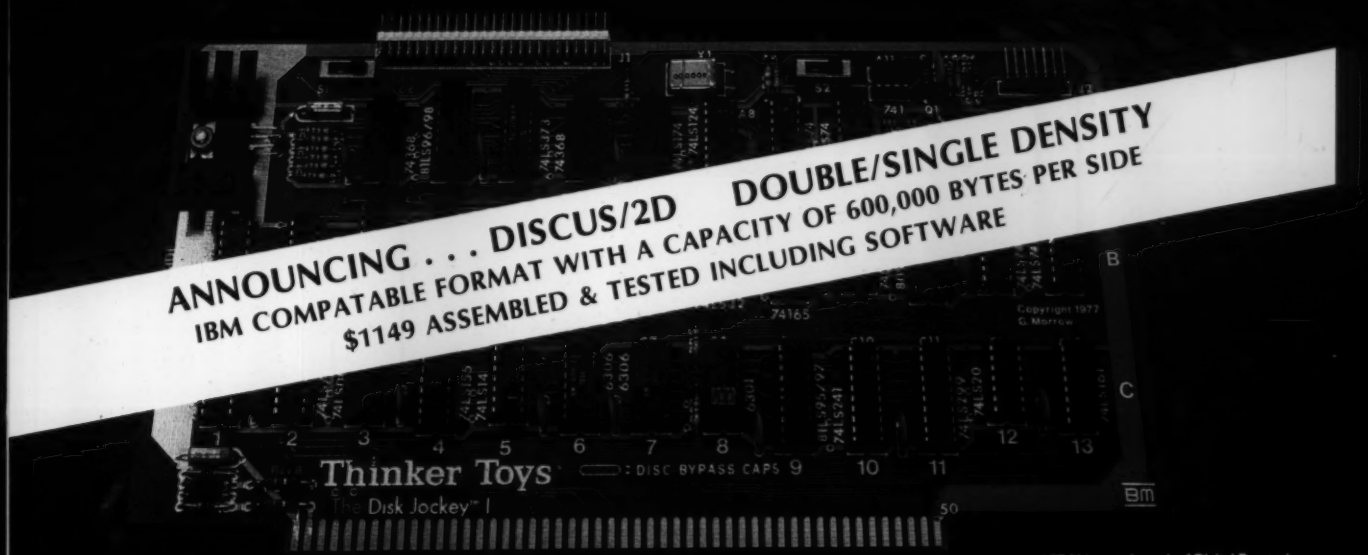
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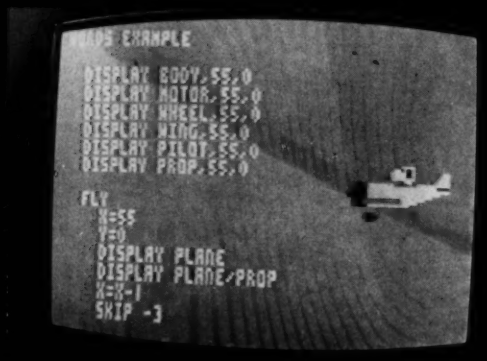
CIRCLE 145 ON READER SERVICE CARD

Atari, the "Video Game People," have come out with two personal computers; the model 400 for home use and the model 800 for business applications. The 400 has a touch keyboard, cassette interface and some fantastic educational, entertainment and home applications software. The 800 has a standard ASCII keyboard, cassette, floppy and printer interfaces with business software packages (touch-typing trainer, payroll, charge account management...just to name a few). Both systems are 6502-based, use voice prompts via the 2nd channel of the cassette and come with BASIC. Atari Inc., 1265 Borregas Ave., PO Box 9027, Sunnyvale, CA 94086.

You haven't seen this one before. The Cybervision 2001, which was originally introduced in the Spring '78 Montgomery Ward catalog, has undergone a facelift. This is the Cybervision 4001, which will be available about the middle of this year. The collection of educational and graphics games available for the 2001 (and 4001) is impressive. The system uses dual 1802 microprocessors in a multiprocessing mode and some of the techniques they use are fascinating. Hopefully, we'll have a review of the system soon. Broadrein Instruments, 1057 Checkrein Ave., Columbus, OH 43229.



It always does my heart good to see floppy disks interfaced to a system which was previously without them. The folks at Bally have added much more than just a floppy, however. Their new Level III machine has a full ASCII keyboard which puts it in a different league than it was before. Dick Ainsworth, one of the system's software developers, gave me a fascinating demonstration of the machine's GRAFIX language. It's derived from GRASS, the graphic language used for making the movie Star Wars (see p. 96, May/June 1978 Creative Computing). The photo shows a complete, modularized program for generating an airplane...and then making it fly across the screen! We must see more of this! Bally Consumer Products Division, 10750 W. Grand Ave., Franklin Park, IL 60131.

One of the most exciting, and interesting, microprocessor-controlled consumer products I ran across at the show had to be the Energy Monitor from Dumont Energy Management Corp. The unit uses an Intel 8048 microprocessor and provides 8 functions: amount of last bill, current bill, projected next bill, billing date, owner's energy budget, cost per kilowatt hour, date & time. Fascinating, isn't it? They say you're going to save more energy because you'll be aware of how much you're using. Makes sense. Suggested retail price is $295. 3301 Conflans—Suite 102, Irving, TX 75061.

Getting ready to do some traveling? What you need is a Craig Translator & Information Center to take along! This ingenious device will give you the French, Spanish, Italian, Japanese, or German translation for an English word you type in. It also performs metric conversions and serves as a calculator. Craig Corporation, 921 W. Artesia Blvd., PO Box 5664, Compton, CA 90220.

If someone had told me that Mattel, Inc. was coming out with a home computer I would have been surprised . . . and I was! I was also surprised, and impressed, with what they came up with. Mattel's Intellivision has an incredible array of games (3-dimensional . . . not just a flat image on the screen!), such as football, baseball, auto racing, armor battle (tanks), space battle, backgammon, checkers, blackjack and poker . . . just to name a few. They've also got math and spelling exercises along with speed reading and French . . . and financial planning and personal improvement. Whew! It's one thing to come out with a system . . . but quite another to come out with all that software, too! The computer is based on a 16-bit micro from General Instruments and has a full ASCII keyboard, voice input (microphone), voice output (via cassette) and 2 remote keypads/controls for game playing. The only drawback to the system is the fact it isn't user-programmable. That's coming along in 1980. Mattel Electronics, 5150 Rosecrans, Hawthorne, CA 90250.

Did you know that one of the finest tape recorder manufacturers, Teac, is now making a floppy disk drive? The Teal SHC-8000 computer system is one of the first systems to make use of them. They're aiming for a price of under $4K for the system with dual Teac drives (90 Kbytes each) and an 80 column, 84 LPM, Cito printer. The system is Z-80 based and comes with 16K RAM, Microsoft Basic and a 16K operating system in ROM (hmmm, sounds almost like a TRS-80). Business software is under development. Target price is $1499. (Hey, is that Chuck Newman, of Newman Computer Exchange, on the right? I believe it is!) Teal Industries, inc., Victorial Business Park, 251 East Victoria Ave., Carson, CA 90746.

Another item from Mattel is this unusual coffee table/pinball machine. The pinball machine can be seen down through the glass top . . . and when turned off, it's completely dark inside. The controls are at the right (see the flipper on the side?). What a way to find room for a pinball machine in your home!

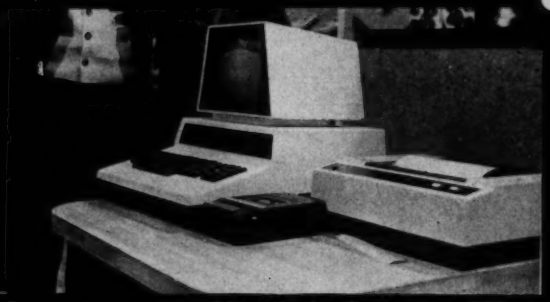
How do you like that new video/disk unit Exidy has come up with for the Sorcerer? It has dual, double-density Micropolis drives and sells for $2195. (Exidy, Inc., 969 W. Maude Ave., Sunnyvale, CA 94086). Some new disk-based business software is now available for the Sorcerer from Compumax Associates, 505 Hamilton Ave., Palo Alto, CA 94301. These include Inventory, Payroll/Personnel, General Ledger, Accounts Payable & Receivable. The packages sell for $140 each and are also available for the TRS-80 and Apple II.

Ohio Scientific has some new goodies! They have a Home Control Option for controlling up to 16 circuits ($249). Are people finally going to start using these things to turn the sprinklers on and off? (That and much more, I'm sure.) They've also got an interesting Color/Sound option ($200). We'll get both of these reviewed in an upcoming issue. OSI, 1333 S. Chillicothe Rd., Aurora, OH 44202.

Integrated Circuits Packaging, Inc., has a telephone that'll sure capture your fancy . . . especially if you have $229.95 to buy one with! This little jewel is a calculator (even when you're talking), a timer, a clock, an alarm clock, memory dialer and automatic redialer. I was impressed! (It uses a National Semiconductor SC/MP microprocessor.) ICP Marketing, 3031 Tisch Way, Suite 750, San Jose, CA 95128.

It's a shame this photo is in black & white because one of the nicest features of the Compucolor II is the fact it comes with a color monitor. An 8K system sells for $1495 but this includes the monitor, full ASCII/graphics keyboard, single mini-floppy disk drive (mounted in the right-hand side of the monitor) and many more features. (Looks to me like the only thing missing is lower-case characters.) They've got a bunch of new software available, ranging from games to a personal data base to income tax preparation. Compucolor Corp., PO Box 569, Norcross, GA 30071.

I thought it was disgraceful the way some companies were using the sex appeal of good-looking, young ladies to help sell their products. Conventions are already somewhat of an ordeal and things like this don't help matters at all!



Do you see what I see? Yep, that's a Commodore PET with a standard ASCII keyboard (complete with graphics). Looks, and feels, very nice ($995). They've also got a new mini-disk system for the PET and by eliminating the clock pulse with each byte it provides 171.5 Kbytes storage per drive ($595). But, the most significant new item is a manual called The PET User Manual. Send $3.50 and proof of purchase and they'll mail you a copy. 901 California Ave., Palo Alto, CA 94304. (By the way, if you get the GERMAN microcomputer magazine called Chips, be sure and see the beautiful ad for the PET in there. Really nice.)

If you're into astrology you'll certainly want to look into the latest from Coleco; the Zodiac Astrology Computer. It took two years to develop and has been tested by ten leading astrologists. Plus, the manual was written by Sydney Omarr, a world famous astrologer. Coleco has an incredible lineup of video games and electronic toys that will interest you. Send for their catalog: 945 Asylum Ave., Hartford, CT 06105.

Here's the "Freedom Dialer" from Royce, the people who probably made the CB in your car. It uses an Intel 8048 micro to provide autodialer, memory, clock, calendar and elapsed timer functions. Smart looking unit. (Sorry, I didn't get a price.) Royce Electronics Corp., Phone Div., 1746 Levee Rd., No. Kansas City, MO 64116.

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Radofin has quite a selection of video games, selling in the $70 to $80 range and as low as $14.95. They've got 6 different cartridges for the Programmable Video System shown in the photo. Radofin Electronics, Portland House, 11th Floor, 41B Ma Tau Wei Rd., Kowloon, Hong Kong.

Interact now has Microsoft BASIC available for their machine (for $49.95) along with some very good applications and entertainment programs. They've got 7 cassettes in their Strategy game series, 7 in the Educational series, 6 Action series (color graphics, too) and 4 in the home Management series. $499 for a minimum 8K system. Keep your eyes peeled for a review of this one in an upcoming issue. Interact Electronics, Inc., PO Box 8140, Ann Arbor, MI 48107.

For those of you who have never met this gentleman, allow me to introduce Bill Gates. Bill, along with Paul Allen, make up the brains behind the industry-standard Microsoft BASIC. It looks like their Fortran and Cobol (and APL) will be following in the steps of that BASIC, too. Microsoft recently left the dry of Albuquerque for the wet of Seattle and their new address is 10800 NE Eighth, Suite 819, Bellevue, WA 38004.

The PeCos I, using its own PeCos Language, was alive and well at the show. We've got a unit lined up for review by Karl Zinn, one of our finest contributing editors. We'll be looking forward to his report. APF Electronics Inc., 444 Madison Ave., New York, NY 10022. ■

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CIRCLE 133 ON READER SERVICE CARD

Apple-Cart

by Richard A. Milewski

Dick Milewski is president of The Software Works, Inc. (PO Box 4386, Mt. View CA 94040), a company which has developed several application packages for North Star disk-based systems. They are currently developing similar application programs for the Apple.

This month we will examine a little noticed capability of the Apple Disk II system. Buried in the middle of page 27 of the 7/78 edition of the DOS manual is a very brief description of something called the EXEC command. The DOS manual states, in part, that the command is . . . "Similar to RUN except that f [the filename] is a file containing commands (including BASIC statements) as they would be issued from the keyboard. This allows you to set up files that control the APPLE much as you would yourself."

With these few words and a brief paragraph devoted to the format of the command, the manual glosses over a facility with more potential to ease programming problems than any other command in the entire Disk Operating System. The easiest way to illustrate the use of the EXEC command is through the use of a few examples.

Program number one, the first of our examples, will create an exec file which contains the necessary commands to clear the screen, load the program from disk and list it, clear the screen again, list the disk directory (catalog), delete the program from the disk, clear the screen a third time, and, finally, list the directory again.

While this process is interesting to watch, it is of limited utility. A more useful function is performed by program number two. This program will create an exec file which will convert a collection of programs from the ROM version of Applesoft II to the cassette version (i.e. disk version). Note that the program assumes that the files are locked when the operation commences, and relocks them on completion of the conversion. The list of programs to be converted is entered as data statements beginning in line 1000. Program number three is identical to program number two except that the conversion is done in the opposite direction, i.e., from cassette Applesoft to ROM Applesoft.

Similar programs may be written to transfer programs from one disk to another, and to perform similar functions usually orchestrated from the keyboard. These techniques are particularly useful when an operation must be performed on many programs and the risk of typing errors increases.

The exec file can also be used to enter, modify, or delete lines of BASIC programs. Indeed, the possibility of creating programs which write exec files which create other programs does exist. Stopping just short of this, program number four will write an exec file which adds two subroutines to a list of programs. In this case the subroutines added are designed to disable, and re-enable the DOS so that INPUT statements will not respond to DOS commands. This exec file will add the subroutines but the subroutine calls (GOSUB statements) are not added as these would occur in different places in each program. The subroutine starting at line 30000 would be called once just before each input statement which expects input from the keyboard. The subroutine beginning at line 31000 would be called immediately after the input statement.

For those who consider self-reproduction to be the prime definition of life, we present a program/exec file combination which is 'alive,' at least within that narrow sense. Program number five will create an exec file which will destroy the program and then proceed to create a duplicate of the program which will create an exec file which will ... ad infinitum, ad nauseam. I leave to the reader the question of determining which came first, the program or the egg-xec file, as well as the task of creating a program/exec file combination which not only 'lives,' but is capable of evolution.

Finally, program number six is a general purpose exec file creation utility. It may be used to build exec files of a non-repetitive nature.

Software

Apple owners looking for a source of programs and other information about their machines often band together to form clubs and user's groups. One of the larger of these is the Apple Corps based in San Francisco, California. They welcome membership inquiries from Apple owners around the world, and currently have a library of more than two hundred programs. Membership inquiries should be directed to:

The Apple Corps
Box 4816
San Francisco, California
94101

(A 6 by 8 inch self-addressed stamped envelope bearing 28 cents would help ensure the continued fiscal health of the club treasury.)

Other Apple owner's organizations are invited to make their existence known in this column. If there are a sufficient number, we will present a directory of Apple clubs in a future issue. Please indicate whether memberships are invited from outside your local area. (While it is nice to be able to have access to software from around the country, being able to discuss a programming problem with someone who has been there before is often a necessity for the newcomer.)■

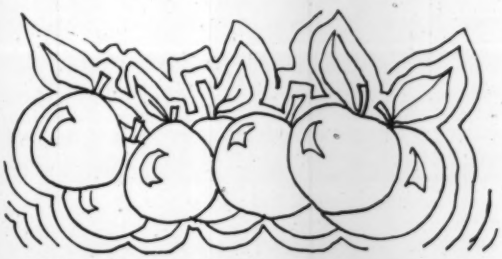
```
10  REM  PROGRAM NUMBER ONE
20  REM
30  LET D$ =  CHR$ (4)
40  PRINT D$;"OPEN COMMANDS"
50  PRINT D$;"WRITE COMMANDS"
60  PRINT "HOME"
70  PRINT "LOAD PROGRAM NUMBER ONE"
80  PRINT "LIST"
90  PRINT "HOME"
100  PRINT "CATALOG"
110  PRINT "DELETE PROGRAM NUMBER ONE"
120  PRINT "HOME"
130  PRINT "CATALOG"
140  PRINT D$;"CLOSE COMMANDS"
150  END
```

```
10  REM  PROGRAM NUMBER TWO
20  REM
30  LET D$ =  CHR$ (4)
40  PRINT D$;"OPEN COMMANDS"
50  PRINT D$;"WRITE COMMANDS"
60  READ N$
70  IF N$ = "QUIT" THEN 9000
80  PRINT "UNLOCK ";N$
90  PRINT "LOAD ";N$
100  PRINT "CALL 3314"
110  PRINT "SAVE ";N$
120  PRINT "LOCK ";N$
130  GOTO 60
1000  REM  DATA LIST
1010  DATA  "PROGRAM ALPHA"
1020  DATA  "PROGRAM BETA"
1030  DATA  "PROGRAM GAMMA"
1040  DATA  "PROGRAM DELTA"
1050  DATA  "QUIT"
9000  PRINT D$;"CLOSE COMMANDS"
9010  PRINT D$;"EXEC COMMANDS"
9999  END
```

```
10  REM  PROGRAM NUMBER THREE
100  PRINT "CALL 54514"
```

(Rest same as Program 2)

```
10  REM  PROGRAM NUMBER FIVE
20  REM
30  LET D$ =  CHR$ (4)
35  PRINT D$;"DELETE COMMANDS"
40  PRINT D$;"OPEN COMMANDS"
50  PRINT D$;"WRITE COMMANDS"
60  PRINT "NEW"
70  LIST
80  PRINT "RUN"
9000  PRINT D$;"CLOSE COMMANDS"
9010  PRINT D$;"EXEC COMMANDS"
9999  END
```



```
10  REM  PROGRAM NUMBER FOUR
20  REM
30  LET D$ =  CHR$ (4)
40  PRINT D$;"OPEN COMMANDS"
50  PRINT D$;"WRITE COMMANDS"
60  READ N$
70  IF N$ = "QUIT" THEN 9000
80  PRINT "UNLOCK ";N$
90  PRINT "LOAD ";N$
100  PRINT "30000 REM DISABLE"
110  PRINT "30010 DA=PEEK(54)"
120  PRINT "30020 DB=PEEK(55)"
130  PRINT "30030 DC=PEEK(56)"
140  PRINT "30040 DD=PEEK(57)"
150  PRINT "30050 PR#0:IN#0"
160  PRINT "30060 RETURN"
200  PRINT "31000 REM ENABLE"
210  PRINT "31010 POKE 54,DA"
220  PRINT "31020 POKE 55,DB"
230  PRINT "31030 POKE 56,DC"
240  PRINT "31040 POKE 57,DD"
250  PRINT "31060 RETURN"
300  PRINT "SAVE ";N$
310  PRINT "LOCK ";N$
320  GOTO 60
1000  REM  DATA LIST
1010  DATA  "PROGRAM ALPHA"
1020  DATA  "PROGRAM BETA"
1030  DATA  "PROGRAM GAMMA"
1040  DATA  "PROGRAM DELTA"
1050  DATA  "QUIT"
9000  PRINT D$;"CLOSE COMMANDS"
9010  PRINT D$;"EXEC COMMANDS"
9999  END
```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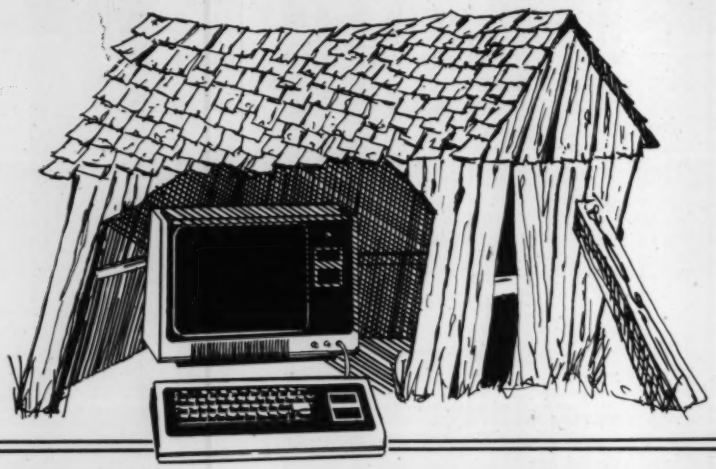
CIRCLE 123 ON READER SERVICE CARD

TRS-80 Strings

Stephen B. Gray

For the fourth TRS-80 column, let's look at a collection of 100 programs that include much home-usage and financial software, the CLOAD T-shirt, graphics and lunar-lander programs from IMI, and a peek at some forthcoming items from Radio Shack.



The Library 100. For $49.50, you get what the ad says is "a beautiful vinyl binder, 5 cassettes with 100 programs, a 36-page instruction manual," either from your local computer store, or from The Bottom Shelf, Box 49104, Atlanta, GA 30359.

The programs are all written for the Level-II TRS-80; the manual explains that "The Library 100 will not be offered in Level I Basic. We did not feel we could provide you with an adequate level of quality considering the limitations of the level I language.... Much of our planned future software will require at least one disk unit and 32K of memory."

The program mix is eclectic, interesting, and curious. There are some financial programs I'd use only once in a lifetime, and some games meant for children. But all in all, I suppose this mix will have as much general appeal as any other 100 programs you could offer.

In the 100, there are some programs you'll probably run again, many you might run again, and a few you'll run only if you really need to. For instance, the *Business and Finance* tape contains 25 programs you may never use, such as Present Value of a Future Sum, Internal Rate of Return, Bond Yield to Maturity, and the highly complex Real Estate Capital Investment program.

The last program on that tape doesn't belong. Moving Ad is one of ten programs—too high a percentage—that display moving messages in various intriguing ways on the TRS-80 screen. If you're a Radio Shack manager and want an interesting eye-catcher for the store window, or running an open house at a school, these are fine; if not, you'll probably not find much use for them.

The *Education* cassette is aimed at elementary and jr. high age children. It contains programs for drill in math: Add, Subtract, Multiply/Divide, Fractions/Decimals, each at several selectable levels of difficulty. A Base Number program converts any number from one base to another, if you're really into that sort of thing.

The two biggies on this tape are Eduquiz and Tiny Pilot. Eduquiz offers a menu of ten subjects with five different ways to work with each. You can be drilled or quizzed in different ways (multiple choice, true and false, matching, fill in the blank), on the 50 states and their capitals, or their date or order of entry into the union, or their abbreviation or largest city; inventors and inventions, world capitals; authors and their books; presidents, etc. Problems are selected at random; you don't know what's going to be asked next, within the selected category. This program could be of great interest to children *and* parents.

Tiny PILOT, referred to in the manual as a "nontechnical noncomputer-specialist language developed out of the need for CAI, Computer Aided Instruction," is offered in 4K and 16K machine-language versions. Six sample programs show how to use the ten Pilot instructions; the manual says "a child can be programming PILOT within a matter of minutes." This is a fascinating language for those who want to try using a limited instruction set.

With the *Graphics* tape, things begin to look up even more. Of these 15 programs, Wierd (sic) makes fascinating use of randomly-chosen graphics characters in tracing a random path, Rat Race does about the same but uses a period instead of the 63 characters, and Fireside makes great allover designs that look somewhat like modern rugs. Eight of the 15 are programs that, as the manual puts it, "may be used for advertisements," while "many of the other programs are merely light and entertaining," which is somewhat of a put-down for non-commercial graphics.

The *Home* tape is odd. Five of the programs are more easily handled as three-by-five file cards: Bartender (drink recipes), Vacation Check-Off List (a simple list of what to remember), Night Check-Off List (same idea), Baby Sitter (phone numbers and rules for babysitters), and Christmas Card List.

Several of the programs could be quite useful to some: Nutrition (adds up calories and carbohydrates for a meal), Calculator (provides 11 functions), Expense (lets you itemize all of them), and Drunkometer (tests your reaction time). The rest are padding, more or less: conversion of weights and measures, perpetual calendar, list of important phone numbers, etc.

The tape of perhaps the highest interest to most of us is *Games*, with some 30 items, including Towers of Hanoi, Russian Roulette, Spy Ship, Jumble Words, Sting Ray, Wheel of Fortune, etc. The best are Doomsday (similar to Star Wars—down the trench), Sketch, Star Blazer, Road Race (not timed, though), Life, Fifteen, and a real-time Star Trek, in which the Klingons are singularly hard to provoke.

Often of more interest than some of the games themselves is the challenge to find out what makes them work, such as Horse Race, Unjumble (helps you cheat on the word-jumble games), and Russian Roulette. Only a couple of the 100 have any REMs at all, so you're on your own.

What's the verdict? If I had a Level-II TRS-80 and one or more grade-school children, or if I were a hardcore software collector, or if I had little software and wanted to get a lot of it with a minimum of bother, I'd buy The Library 100.

Incidentally, I counted 96 programs,

but even then, 52 cents each isn't all that much. The Bottom Shelf figures that each of the categories in Eduquiz is a program, so their count is 104, an even better bargain, at 48 cents a program.

By the way, the January TRS-80 column contained a review of The Library 100, but I didn't write it. The author was Steve North, *Creative*'s resident software genius. Somehow *Creative*'s Joint Editorial Reconciliation Combobulator (JERC) merged the two items improperly, due to an incomplete match of author's names, caused by a post-nasal glitch.

CLOAD T-Shirt. The publishers of CLOAD, the monthly TRS-80 magazine on cassette, now offer T-shirts bearing a cleverly anthropomorphized cassette holding a sign, "TRS-80's of the world UNITE." You can get the figure in black on a yellow T-shirt, or in dark blue on a blue one, in XL, L, M and S sizes at $7 each, from CLOAD magazine, Box 1267, Goleta, CA 93017. CA residents add $0.36 tax.

The Sept. 1978 CLOAD, by the way, includes Petals Around the Rose, Hamurabi, and Othello, in Level-I and Level-II, and Life in Level-II only. All four should be familiar to anybody who calls himself a computer gamesman.

The Oct. 1978 CLOAD has fascinating "cover" graphics (random solid rectangles that reset overlapped previous ones), Star Wars (three levels of play, with TIE-fighters menacing while you try to get the bomb in place and pull out of the trench in time), Graphic (draws a continuously-moving and changing herringbone pattern, quite enchantingly—but in the Level-I version nothing gets reset so the pattern eventually becomes entirely white), Chase (homicidal robots chase you), Passbook (lets you check the accuracy of your bankbook, or simulate one), and Machin (demonstration of how quickly the entire character set can be displayed from machine language on tape). This cassette is well worth sampling, at $3.50, if you're not already a subscriber to CLOAD at $36 a year.

You can get CLOAD's cassetteman in black on a yellow T-shirt, or in dark blue on a blue one, for $7.

Interactive Microware. In addition to offering "microware" for 8080 computers, Interactive Microware, Inc. (Box 771, State College, PA 16801) offers two TRS-80 programs on cassette for Level-I 4K machines, at $4.95 each.

The Compact Graphics Interpreter, TRS-80-CGI, provides an ingenious subroutine for drawing "elaborate pictures ... without having to write lengthy programs," as the instruction sheet puts it. You use "a single number to specify the drawing of a line to any location on the screen," and the subroutine does all the hard work.

This graphics program uses six-digit words, with the first digit the type of command; the remaining five are for command arguments. You use 100000 to CLEAR SCREEN; 210000 for SET MODE or 200000 for RESET MODE; 3XXXYY to LOCATE X,Y by setting the initial graphics block, with XXX=0 to 127, YY=0 to 47; 4XXXYY to INCREMENT X,Y by a delta amount; 5XXXYY to draw an ABSOLUTE LINE from the current location to the specified one; 6XXXYY to draw a RELATIVE LINE from the current location to one relative, plus or minus, to an XXX of 500 and a YY of 50; 700LLL for JUMP TO COMMAND at array location A(LLL); 800LL for JUMP TO SUBROUTINE at

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CIRCLE 134 ON READER SERVICE CARD

array location A(LLL); and 9DDDDD for DIGIT SWITCH, which sets individual graphics blocks, one location for each D, the direction depending on the value of D (1 for up, 2 for NE, 3 for right, around to 8 for NW), and this keeps going until another 9 is encountered, so you can use several words for this command.

TRS-80-CGI is recorded four times on the cassette. Each includes a sample program that draws an elaborate building front with columns and dome (which is actually the "Old Main" administrative building on the campus at Penn State University), using only 73 six-digit words. You LIST the program, delete all the lines except the subroutine, write your own program, and RUN.

If you order TRS-80-CGI, IMI will include a listing of their short but powerful *Etch and Sketch* program that lets you draw figures from the keyboard. The same listing sheet also contains the one change you need to make if you want to use the Compact Graphics Interpreter for Level-II machines.

The Lunar Lander Simulator, TRS-80-LLS, is a "real-time simulation, control of Lunar Module through *continuous* keyboard interaction, module movement and instrument panel display through *high-speed* machine-language graphics," the brochure says.

You start at altitude 30,000 feet, with a velocity of -100 ft/sec vertically and 400 ft/sec horizontally, and a fuel supply of 1,000 pounds. You have five controls: up-arrow for module up, right-arrow to make module head to the right, left-arrow to make it head left, 1 to turn the rocket engine ON, 0 to turn it OFF.

Deceptively simple. The designer, IMI's president Dr. Frank Vastola, who is a fuel scientist and professor of Materials Science at Penn State, says the module *can* be landed without crashing it, but I didn't really believe that for the first two dozen tries. A hint: get rid of the horizontal velocity component as soon as possible.

Coming up from IMI, and which I'll review in detail when I've seen them, is a Level-II CGI that uses PEEK, POKE and USR for maximum speed, a billboard display program that creates characters a quarter the height of the screen, Battlegrid program for two people to play an interactive game like Battleship, and a music cassette that lets you write music, display it on the screen, and play it through the cassette output to a hi-fi.

Coming. By now you've probably seen ads for the latest TRS-80 add-ons, which may be available by the time you read this. Starting this last January 1, all 16K machines sent out of Fort Worth have a numerical calculator keypad on the keyboard, at the right end where the nameplate was. The dozen keys are for 0 to 9, decimal point, and ENTER. This keypad will also be installed on all 16K upgrades. As an add-on for present owners, it will cost about $60.

A Voice Synthesizer, which will say "cat" when you input C99T, should be about $400. A two-way modem and acoustic coupler, the Telephone Interface II, will be about $200. And there's some 35 new software packages coming, including General Ledger.

More on this new hardware and software when I've had the chance to check them out. These prices are all unofficial, so don't be surprised if the announced prices are different. ■

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by Gregory Yob

I am happy to hear from you, and encourage your correspondence. I will try to acknowledge all correspondence, and a SASE makes things easier for both of us. Please send your letters to "Personal Electronic Transactions" c/o PO Box 354, Palo Alto, CA 94301.

The PET Clock

The PET has two "reserved variables," TI and TI$ which are used for keeping the time. TI is a floating point variable which counts the number of ticks, or "jiffies" since the PET was turned on (or the time reset). A "jiffy" is 1/60 of a second.

TI$ is a 6 character string that holds the time in the format HHMMSS (Hours, Minutes, Seconds) on a 24-hour clock. TI$ can be assigned a new value to reset the PET's clock.

The PET's clock runs from the 60 hz interrupt that takes care of various "housekeeping" functions such as scanning the keyboard and updating the clock. Though the interrupt processing takes about 10% of the PET's time, the other 90% is available to you—and for most uses, the PET's interrupt is never seen. Let's move on to some examples with the PET's clock.

Turn on your PET and enter: PRINT TI,TI$. You will see something like: 2071 000034. The PET has been on (in this case—your number will likely differ) for 2071 "jiffies," or 34 seconds. Jiffies can be converted to seconds by dividing by 60. Try: PRINT TI/60, TI$. I got: 184.183333 000304 and indeed 184 seconds is 3 minutes and 4 seconds.

The next experiment is to try resetting the clock. If you try: TI=1234, you will see ?SYNTAX ERROR—the PET will not permit the direct setting of TI. However, TI$ is more amenable. Enter: TI$="010101": PRINT TI$ and 010101 will appear—the PET's clock has been set to the new time.

I will leave it to you to verify that TI$ will only accept a 6 character string of numerals only. You will get an ?ILLEGAL QUANTITY ERROR for your incorrect attempts. TI$ is remarkably tolerant of other inputs, provided they are numbers. For example, the entry 303030 will result in the clock being set to 000000. Here is a small program for exploring this behavior:

```
10 INPUT"TIME HHMMSS";TI$
20 A$=TI$
30 PRINT A$
40 IF A$=TI$ THEN 40
50 GOTO 20
```

This program accepts a value for TI$ and immediately prints it. Then idles until TI$ is seen to change, and the time is re-displayed. The result is something like:

```
RUN
TIME HHMMSS? 102030
102030
102031
102032
etc....
```

If values beyond 24 hours, or minutes past 60, etc. are entered, TI$ behaves reasonably. Here are some examples:

```
TIME HHMMSS? 000099
000139
000140
TIME HHMMSS? 300000
300000
000000
000001
```

Some experimentation will result in: 1) Times over 60 in seconds, or minutes, will be corrected to the right time—for example, 99 seconds becomes 1 minute 39 seconds. 2) Times over 24 hours will be reset to 000000 unless the value is over 774021. Higher values behave as if 774021 were subtracted first—try 999999 and see!

Further experimentation reveals that the 24 hour roll-over is a bit peculiar:

```
TIME HHMMSS? 235958
235958
235959
240000
000000
000001
```

At 24 hours, *both* numbers suddenly appear! (without the 1 second delay between them.) Those of you trying to make timers for more than 24 hours take note— the test should be for 000000, not 240000.

You might have noticed that the first value entered remains until 1 second has passed—this brings out two details of the PET TI$ function. First, when TI$ is assigned a new value, the string TI$ is converted to the jiffies value— and then the jiffies value is used to generate TI$. This explains what happens with 99 seconds, etc. Second, the jiffies counter can hold a maximum time of

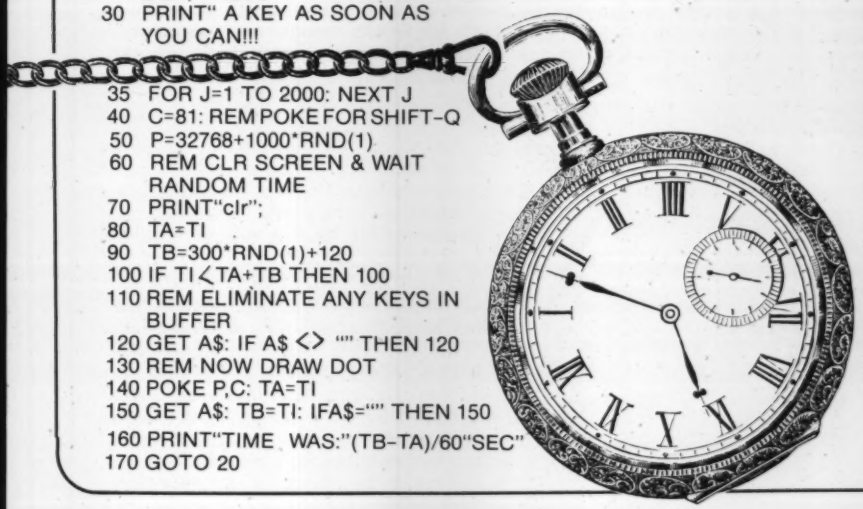
774021, and is checked each second for a value over 235959. When this condition is detected, the clock is reset to zero. Until the second ticks past, TI$ will be whatever it was assigned by BASIC.

For most practical uses it suffices to keep the time within 24 hours and the PET's clock will work just fine.

Some dedicated souls have checked the PET's clock for accuracy—the truth is that the PET clock isn't very good. The values vary, but the PET will gain about 4.3 seconds/hour when running a program, and lose 1.2 seconds per hour when idling. The reasons why are unknown!

The applications of the time function are endless—here is a quickie "reflex-checker" as an example:

```
10 PRINT" clr REFLEXO!!!"
20 PRINT" dn dn WHEN YOU SEE A
   DOT, PRESS"
30 PRINT" A KEY AS SOON AS
   YOU CAN!!!
35 FOR J=1 TO 2000: NEXT J
40 C=81: REM POKE FOR SHIFT-Q
50 P=32768+1000*RND(1)
60 REM CLR SCREEN & WAIT
   RANDOM TIME
70 PRINT"clr";
80 TA=TI
90 TB=300*RND(1)+120
100 IF TI<TA+TB THEN 100
110 REM ELIMINATE ANY KEYS IN
   BUFFER
120 GET A$: IF A$ <> "" THEN 120
130 REM NOW DRAW DOT
140 POKE P,C: TA=TI
150 GET A$: TB=TI: IFA$="" THEN 150
160 PRINT"TIME  WAS:"(TB-TA)/60"SEC"
170 GOTO 20
```



Try it out and see—my best time was .23 seconds (if I didn't cheat by banging the space key a lot). There are several details worth noting: Line 35 is a delay loop of the "first kind" (i.e., keep the PET busy doing something useless for a while). Lines 40, 50 and 140 depend on the fact that the PET's display is the 1K bytes starting at the 32K boundary. Address 32768 is the "home" position on the screen. This puts a *Q* randomly on the screen to make the game harder to do.

Lines 80 through 100 are a delay loop of the "second kind" where the PET's TI is used to measure the time interval. In this case, the interval ranges from 2 to 7 seconds. (My first version didn't have the extra 120 jiffies— and the fast ones were hard to do.) This kind of delay loop can be quite useful for many things.

Line 120 prevents cheating—recall the PET will store up to 10 keystrokes before BASIC asks for them. If you remove Line 120, and press a key before the dot appears, you can get a 1-jiffy reflex time which is meaningless.

Line 140 draws the dot, and immediately fetches the time. Line 150 does the GET, fetches the time, and *then* checks for a character. I hope the delay is about the same for both lines (As I recall from biology, a .23 sec reflex time is pretty good.)

If your PET is "wired for sound" (see previous columns on music), a clock with chimes can be built. Most PET owners should have the BIGTIME program by now (Contact Commodore if you don't), and a good project to learn about time is to add chimes and an alarm feature. Skilled programmers can contend with correcting the PET's time gain by resetting TI$.

PET Files

In response to many requests for help concerning tape I/O and the IEEE 488 buss, here is a short introduction to how the PET sees files. I have not yet been able to get an IEEE device to play with, so the IEEE information presented here hasn't been backed up with (painful!) experience. I hope by the next column to present some IEEE examples that have worked....

Those of you interested in data tapes are advised to see Page 82 of the January 79 issue of Kilobaud which has a tutorial article about using PET tapes.

The PET uses the following statements to relate to files:

OPEN—Sets up a file so the PET can use it.

CLOSE—Removes a file from use.

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PRINT#—Write to a file.
INPUT#—Read from a file.
GET#—Read one character from a file.
CMD—Send BASIC's output to a file.
ST—A BASIC reserved variable for I/O operations status.

All of these can be used in programs, and all except INPUT# and GET# can be used in direct mode as well. Here is a look at each of these in more detail:

OPEN (File Number),(Device Number),(I/O Option),(Filename)

OPEN sets up a file and provides the link between the PET and the device being communicated with. The File Number is used in BASIC to identify the file in the INPUT#, PRINT#, and GET# statements. For example, an OPEN 23 .... will later permit the PET to send the data provided by PRINT#23 to this file and not some other file that may also be in use. The legal values are 1 to 255.

The Device Number tells the PET which I/O device to attach the file to. At present the device numbers are allocated as follows:

PET DEVICE NUMBERS
0 Keyboard
1 First Tape Unit (The one next to keyboard)
2 Second Tape Unit (Port in back)
3 Screen
4-15 IEEE 488 Port (primary address)

The I/O Option is used to tell the device what to do. For the tape units, the values 0,1, an 2 are used:

PET I/O Options—TAPE UNITS
0 Read only file
1 Write only file
2 Write only file with End-of-Tape mark when CLOSEd.

The fate of the I/O option is more complicated for the IEEE 488. First of all, it is called a "secondary address," and can have the values 0 to 31. If the OPEN statement has a filename, the I/O option OR'd with hexadecimal F0 is sent when the file is opened. (No filename means nothing is sent.) Later, when the PRINT#, INPUT# and GET# statements are executed, the I/O option will be sent to the device as a "secondary address" before the data transfer is begun. This permits several files to be opened to the same device with different "secondary addresses" for different functions. The PET printer, for example, uses one address for output of data, another for setting format, and so on.

The filename is a string which is used to identify tape files in the tape header—the PET uses the filename to separate programs and data files on tapes. (I don't know what the filename does on the 488 buss.)

The File Number, Device Number and I/O Option can be either literal numbers (i.e., 123) or BASIC expressions. The Filename can be a literal string or string expression. OPEN A+B,2,D%,Z$ is legal (provided A,B,D% and Z$ make sense!).

The comma must be between each item, and if you want to specify a filename, all previous values must be provided as well—even if you don't care about the I/O option.

CLOSE (File number)

CLOSE removes a file that has been opened. If this was a tape file, any characters left in the buffer will go out to tape before the file is removed. (Tape files don't write on the tape after each PRINT#—instead, 191 character "blocks" are written now and then.) If you want to re-use a file, it must be CLOSEd first. The PET permits a maximum of 10 files to be open at any time—and if you open more, the PET will "hang up" without telling you! Be sure to CLOSE your files!

When a file is closed, an "End of Tape" mark will be written if the file was opened with I/O option #2. If the file is an IEEE 488 device, the "secondary address" OR'd with hexadecimal E0 (note the difference) will be sent to the device.

PRINT# (File Number), (Variables list)

PRINT# sends the data in the Variables list to the desired file as specified by the file number. Naturally the file must be OPENed, and the I/O option set to a "write file" mode. (If you fail to do this, you will see errors like ?NOT OUTPUT FILE ERROR or ?NOT INPUT FILE ERROR.)

There is one *very important thing* about PRINT#—what is sent to the file is an exact copy of what would be sent to the screen by an equivalent PRINT. For example, if you have: PRINT#2, 10;20;30 what is actually sent is: sp 10 rt sp 20 rt 30 cr ... the semicolons weren't sent!! This means exquisite care must

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DAM SYSTEMS

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be taken to ensure what is actually on your file is what you meant!! This "feature" can be confusing for tape files, and very difficult for IEEE devices—it is very easy to think one thing and do another. The best cure for these woes is to have the equivalent PRINT as well to show you what is going on on the screen as well.

Less important, but a beginner's error (perfectly excusable) is that PRINT# and ? do not mix well. You must *always spell PRINT#* out in full when entering programs. If you get a ?SYNTAX ERROR in a perfectly good-looking PRINT#, try retyping it in! (Just use the Screen Editor and move the cursor to the 'bad' line & press RETURN.)

INPUT# (File Number), (Variables List)

INPUT# reads the data from the file into the variables in the variables list. The file must be in "read file" mode, or you will get an error.

There are two *very important things* about INPUT#. First, INPUT# works just like INPUT does from the keyboard. This means that for your data files to work, they must be *character-for-character* identical to what you would type in in response to a normal INPUT statement! Nearly all files problems come from the fact that what was PRINTed cannot be INPUT later—the PRINT didn't set up the file as an exact copy of what is expected by INPUT! Second, INPUT# is very fragile and susceptible to bad data—if you have over 80 characters without a carriage-return, or ask for too many or too few variables, etc., the PET will go off into limbo....

To repeat yet again, debugging these things consists of knowing *exactly* what was sent to the file, and making sure that exactly that will work successfully with INPUT#. Use PRINT and INPUT to check these out. One useful item: CHR$(34) is the quotation mark.

GET# (Numeric or String variable)

This is similar to GET from the keyboard—the PET will fetch one character from the file. (If the character isn't there the PET will wait for it until timeout for IEEE, and search the file for tapes.) As with GET, the only useful one is GET (String variable). GET# is fairly fool-proof and lets you read from your file all the characters on it—very useful for debugging!

You can also use GET# to recover from tape files that aren't readable with INPUT#—though the reconstruction work can become wearisome. By the way, neither GET# nor INPUT# will recognize an end-of-file—you have to use ST for this one, or better yet, have your own end-of-file mark which the program knows about.

CMD (File Number)

CMD lets the PET speak in a "direct" fashion to a file. Inside the PET are two software beings—the Operating system, and BASIC. The Operating system manages files, time, keyboard, etc. BASIC thinks that the PET is really a TELETYPE in its heart, and doesn't know or care what the Operating system does with BASIC's output. So, when a LIST is done, BASIC sends a listing to the Operating system, which usually puts the data on the screen as a program listing. CMD reassigns BASIC's output to the desired file. As an example, the following sequence will put a program listing on a tape as data (if there's a program in the PET.)

```
OPEN 1,1,1,"PGM"
CMD 1
LIST
CLOSE 1
CLR
```

Be careful with this! *All* of BASIC's output, including the READY. will be sent to the file. To escape back to normal mode, the CLR is needed. Closing the file is needed to empty the tape buffer.

ST is a special variable which lets you know how the file operation last performed has operated. Each bit in ST has a different meaning, and the AND operation can be used to sort them out.

PET ST VALUES

BIT	VALUE	TAPES	IEEE 488
0	1		Write timeout
1	2		Read timeout
2	4	"short block"	
3	8	"long block"	
4	16	read error	
5	32	checksum error	
6	64	End of file	
7	-128	End of tape	Device not present

For example, checking for an end of tape is done with: IF (ST) AND 128 THEN .... Be sure to use the parenthesis or BASIC thinks the statement is: IF S TAN D, which is nonsense! (I won't explain this one now for space is short. Try entering normal text for a program and LIST it—have fun!)

Errors 4 and 8 will happen if you somehow try to read a program tape as data. Errors 16 and 32 mean your file is bad—that is, for tapes, the PET is unable to read the tape. Clean, demagnetize and pray!

Errors 1 and 2 apply to the IEEE 488. The PET is *not* up to the 488 standard here—the device must complete the handshake within 64 milliseconds or the PET will see these errors. The cure is to use GET# in a loop checking ST as well. Jump back to the GET# or INPUT# if the timeout error is present. A similar approach can be applied to PRINT# for the IEEE.

Errors 64 and -128 are useful—if you check for them constantly! I prefer to

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put a special data marker in my files and check for them instead.

If you have got this far, my sincere congratulations! PET files are not easy to understand, and I could devote several columns to teaching how to use them. If you have to learn with just this article for guidance, it is going to be tough—I suggest that you start with *small* and *simple* examples, like printing and reading one small number or word via tapes.

There are some bugs with the PET tapes and IEEE. For the tapes, the PET won't write tape files with enough room between each data block for the file to be read correctly later. The cure is to turn the tape motor on for a short time (like 10 jiffies) between blocks. To detect blocks, you must keep count of the number of characters written to the file—each block has 191 characters, and when more than that arrive, the tape is written to. The following POKES provide control of the cassette motors:

Unit #1	ON:	POKE 59411,53
	OFF:	POKE 59411,61
Unit #2	ON:	POKE 59456,PEEK (59456) OR 16
	OFF:	POKE 59456,PEEK (59456) AND 239

The procedure for all this is:

1) OPEN your file. Set characters counted to zero. (CT=0)
2) PRINT# to the file. Note the number of characters PRINT#ed. (Be sure to count carriage returns!)
3) Call the motor routine. Then continue.

Motor routine:

1) Add characters PRINT#ed to characters counted. If the number is less than 192, return.
2) Turn the motor ON. Wait 10 jiffys. Turn the motor OFF.
3) Subtract 191 from the characters counted. (CT=CT-191)
4) Return.

Another tapes bug is that certain conditions can make the OPEN statement work unreliably. Users of the 2nd cassette will experience this more often—I haven't seen the problem with the #1 tape unit. Anyhow, Commodore suggests the following before any OPEN statements:

Cassette #1: POKE 243,122:
POKE 244,2

Cassette #2: POKE 243,58:
POKE 244,3

Also worth noting is that the two tape units use the *same* wire for writing. If you have two units, you can't OPEN both for writing as different files and have different data on both tapes. It will all go out together. On the other hand, when you SAVE, both tape units can make a tape together! (Two SAVEs for the price of one.)

The IEEE 488 has some difficulties too. First, the timeout of 64 milliseconds will raise havoc with slow devices. Second, the ATN line goes on between INPUT# and PRINT# statements—which can be hard to live with. Third, LOAD and SAVE operate—with ATN remaining on—to the utter confusion of any devices.

Commodore does offer a fairly complete booklet, "PET Communication With the Outside World"—but you have to request it—which covers PET files and I/O for tapes and the IEEE 488.

A Bit of Relaxation

Here's one for you to figure out (if you can!). Clear the screen and enter the following characters (exactly!):

hm L @ rvs @ cr
(Home, shift L, @, RVS, @, RETURN)

and then: SYS 32768.

Now, press some keys and see what happens.

For some variations, add the character rvs * (reverse shifted asterisk) before the L @ rvs @ combination. For example,

(reset your PET)
clr hm rvs * * * * off L @ rvs @ cr
SYS 32768

You can add as many rvs * as you want in front. ■

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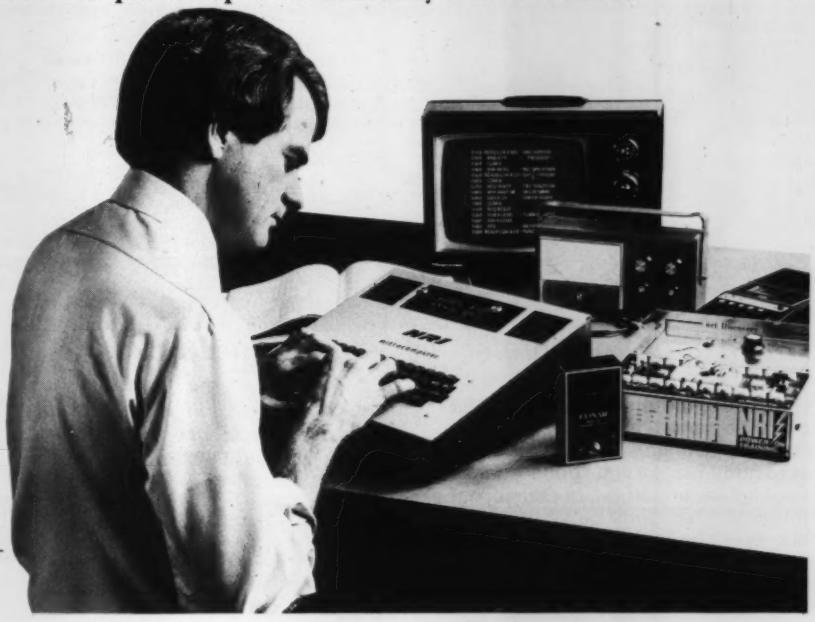

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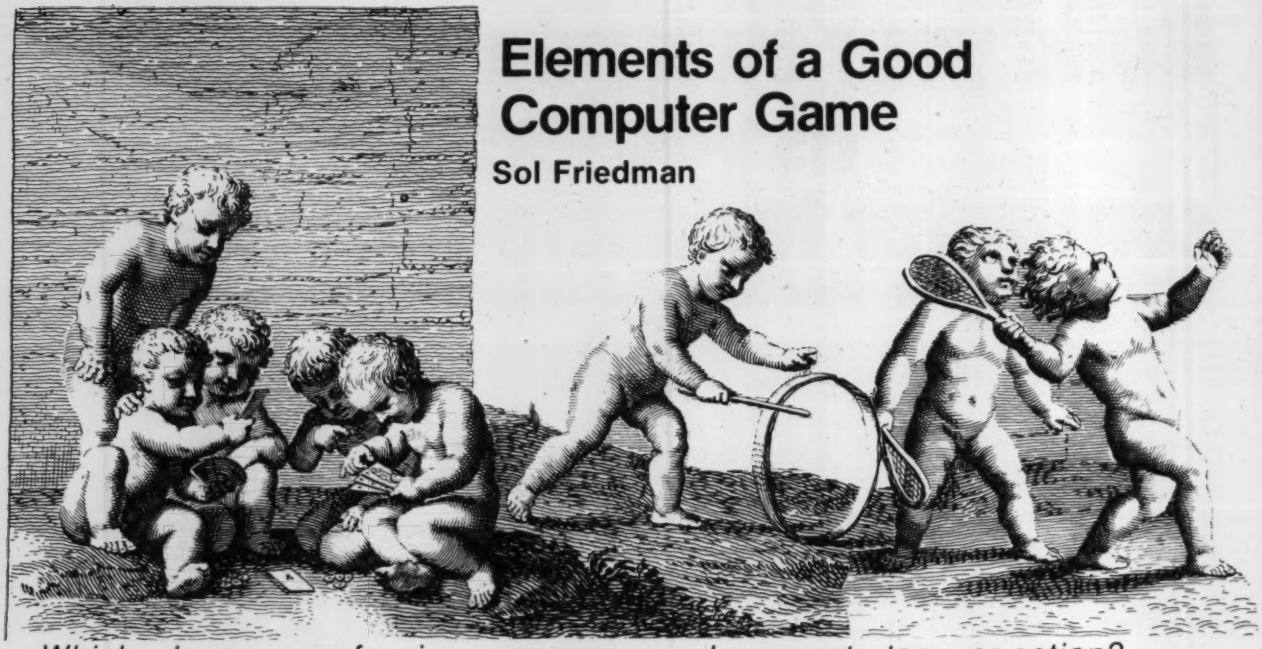
Elements of a Good Computer Game

Sol Friedman



Which do you prefer in your games; chance, strategy, or action?

What are the elements of a good computer game? It might be best to start with the elements that do not necessarily make a good game. Graphics are important, of course, but remember that it will be very hard to beat the graphics in a commercial video game. Action is very important in any kind of game, but here again, the video game features fast action, and our little home computer may be no match in this department. Surely there must be some element in which the personal computer can out-shine all other mediums.

Yes there is, and that element is STRATEGY. No other form of game has the capability for strategic approach that the home computer has because of the computer's ability to keep track of so many elements that are changing all at once. This probably accounts for the great popularity of the better Star Trek programs around. More about this later.

The secret of writing a good computer game program, and in creating a good computer game, is simply to think about the game itself. It must be a good *game*, to be a good computer game. If the game itself is half-baked, an excellent program will not improve it any. Okay, we know that programming, graphics, and action do not of themselves make a good game. Then what are the elements of a good game? The toy industry has been trying to find the answer to this question for about 100 years, but after 20 years of designing games, I'm going to take a shot at it.

Chance-Strategy-Action

There are three basic elements contained in every game;

Chance
Strategy
Action

Examples of games that illustrate these elements are: Dice games (Chance), Chess (Strategy), and TV Ping Pong (Action). Most games have a mix of these elements in varying amounts. No one element is really more popular than any of the others and there are great and popular games that stress Chance, such as most of the board games that use dice or spinners, just as there are many equally popular games that stress strategy, like chess, checkers and many others. There is no need to point out the attraction of action-type games when you think about all of the fine TV-type games which are almost exclusively action-based, plus arcade games and the like.

A good game has some or all of the three elements, but unfortunately, so do the bad games. Looks like we are getting nowhere fast. Now we come to the essence of the matter. The elements we just talked about are used to create in the game player a series of emotional responses while playing the game. Think about how you feel when you are playing a good and exciting game. Tension, exultation, a feeling of power (you are in control of your fate), satisfaction at accomplishing a task well done, conflict with the other players and that nasty but happy feeling when you have knocked the stuffing out of your opponent. And we cannot leave out the important decision-making process in playing a good game. It's great to make decisions that turn out well and lead to victory. And last but not least, that old cliche, the Ecstasy of Victory and the Agony of Defeat. A good game stirs the emotions of the player, even in defeat, and makes him want to try again.

Computer Games

It is sad to note that there are really very few good computer games around for the home microcomputer. But there are some. The Star Trek games that are well done are very good because the Star Trek idea takes advantage of the prime ability of the microcomputer to keep track of many different elements and factors that make up the game. To do this any other way but on a computer would be almost impossible. It incorporates most of the elements we mention above and does it well. Power (you are the Captain of the Enterprise), Tension (as time works against you), Conflict (against the enemy) and so on. Commodore's Space Trek is well done within the limitation of 8K memory, and I am sure there are other good ones around. Commodore also has their version of Othello called Reversal. This program too, is well done and follows all of the play of the original. It's a simple game, but quite fascinating. This is an instance in which the microcomputer does a *better* job than the original board game. Although the game works well as a board game, it

Sol Friedman Associates, 480 Birchwood Way, Ft. Lauderdale, FL 33326.

could be tricky to find every combination to reverse the opponent's pieces by hand without overlooking some. The computer, of course, has no such problem, and automatically carries out the process, without error.

Personal Software has two games on the market that are exceptionally well done. These games are simulations of existing games, not new ideas, but they are quite good. They are Microchess 2.0, and Bridge. The Microchess program is done in machine language, and that is probably how they were able to cram such a sophisticated program into the PET's 8K memory. It plays a fine game of chess and has interesting variations as well. The Bridge program satisfies a personal longing that I have had ever since I started to play Contract Bridge some thirty years ago. That was the desire for some kind of Bridge game that would let me play or practice the game when three other players are not available to make up a foursome. Although there have been a number of simulations and board type games available most were tedious to set up and keeping track of what was happening was a chore and not much fun. Again the computer shines in the bookkeeping department, keeping track of all the variables competently, dealing the cards in infinite variety and acting not only as an opponent, but actually taking the place of *two* opponents *and* your partner at the same time. Now your computer is doing a job that can be done in no other way, and that is what it's all about. You may or may not be enthusiastic about the games mentioned above, but they do illustrate the amazing capabilities and possibilities inherent in the microcomputer and point at vast, untapped possibilities in the future. As a professional game designer for over 20 years, I must predict the development of games far beyond what is available today, whether computer type, or those available from the game companies in the toy industry. I believe that they will be so much more sophisticated and challenging that there will be little basis for comparison.

Getting beat at his own game by Jon, Alan"

The Computer Opponent

I had talked earlier about the great capability of the computer to keep track of a multitude of variables, and that indeed is a most important feature of the computer. But there is no question that *the* most important and valuable ability of the computer in game playing is its availability as an instant and patient partner-opponent. It really is a love-hate relationship that we have with our computer. We love it because it's always there and ready for us to play with as an active opponent. We love it because we can tell it how well we want it to play against us. We love it because it never gets mad, or impatient, or sleepy, or too busy to play. And it never makes new friends and becomes more interested in playing with them than us. It is the truly, ever-faithful companion. No wonder we love it so! We hate it with a passion, however, when it beats the devil out of us at our own game! Boy, that's the pits. "Like to try another game?" I would guess that our reply to that question would be, at times, unprintable!

"Designing a new game on the PET computer".

At the same time, the ability to set the difficulty levels of many games actually becomes a learning experience for us. We set the computer's ability low when we first start, and raise the level and the challenge as we become more proficient. The exercise of the little gray cells is quite stimulating. And it's probably good for us as well. Maybe that's why the think tank boys like to play the computer games so much.

We do lose a very important factor when playing with the computer as our opponent, and that is, of course, a *live* opponent. So what does a live opponent have that the computer doesn't? Unpredictability! Creativity! Intelligence! There is a human and emotional interplay between people that cannot be present with a computer. Nor can the computer respond emotionally to game play situations. This makes game playing with people much less predictable, and therefore adds variations not possible with a computer (and therefore, more interesting). There are also non-computer games that have an element that can never exist in a computer game. This is a kind of psychological warfare that takes place between two players. A Football Game that I designed illustrates this concept perfectly. It

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is a game of strategy called "Monday Night Football" in which the offense plays are compared with the defense plays selected by the opponent. The play results depend on the spread between the offense and defense plays. Thus, a forward pass play against a running play defense will usually show a large gain. Similarly, a running offense play will show a good gain against a pass defense. Conversely, a pass play against a pass defense will be a disaster for the offense, as will a running play against a running play defense. And of course, there are nuances in between. Played against a computer, this could wind up being a rather mechanical kind of game. Played against another human, it becomes especially interesting. I forgot to mention that the players cannot see the play selected by the other until the play result is displayed. Because you cannot see what play your opponent is calling, you have to try to assess what is in his mind. And you have to try to "psych out" your opponent. Thus you may start out on offense playing a very conservative game, until you have the other player convinced that you are a real cautious kind of guy. Then suddenly and surprisingly, you call some wide open, dangerous plays to try to catch him flat footed. Then you switch back to the original style, and then alternate unpredictably. That adds a great deal of fun to the game, above and beyond the game itself. It's a real mental struggle. I guess that's why Aurora Products sold several million games.

Working on zodiak , a new astrology computer"

Computer Non-Games

I hope I won't be stepping on too many toes in what I am about to say. My object is not to hurt people's feelings, but in some small way contribute to the improvement in the state of the art of computer games. Road-Racing games, basketball games, and the like that pretend to play the game, but are almost wholly based on pure chance and use little or no strategy, and little or no graphics, are not really good games. It's no fun to watch the screen tell you to select a basketball shot, and after you take the shot say, "Oops, sorry, you missed!!" or "Hey, great, you score!" Who cares? You were not involved in any decisions, you did not plan any strategy, you weren't required to exercise any skills. Therefore, you didn't earn either victory or defeat.

This is a personal feeling and I might as well burden you with a personal opinion about a category of computer non-games. The games I am talking about are the Dice-type games, games of chance, some card games that involve very little of anything but pure luck. I get tired of playing those well before I start. Real dice games can be exciting when there is real money at stake and where there are real people involved. But mainly when there is real money involved. Likewise, black jack, roulette, slot machines and others. These games, when played on a computer, have few of the elements of good games we have been talking about. They do have some redeeming factors, however, if you are fooling with them in order to familiarize yourself with the odds of winning money at these games in Las Vegas. In that respect, they can be of limited value. Just remember that you may be a world-beater at the game on your home computer, but still lose your shirt when real money is at stake. Make no mistake about that! ■

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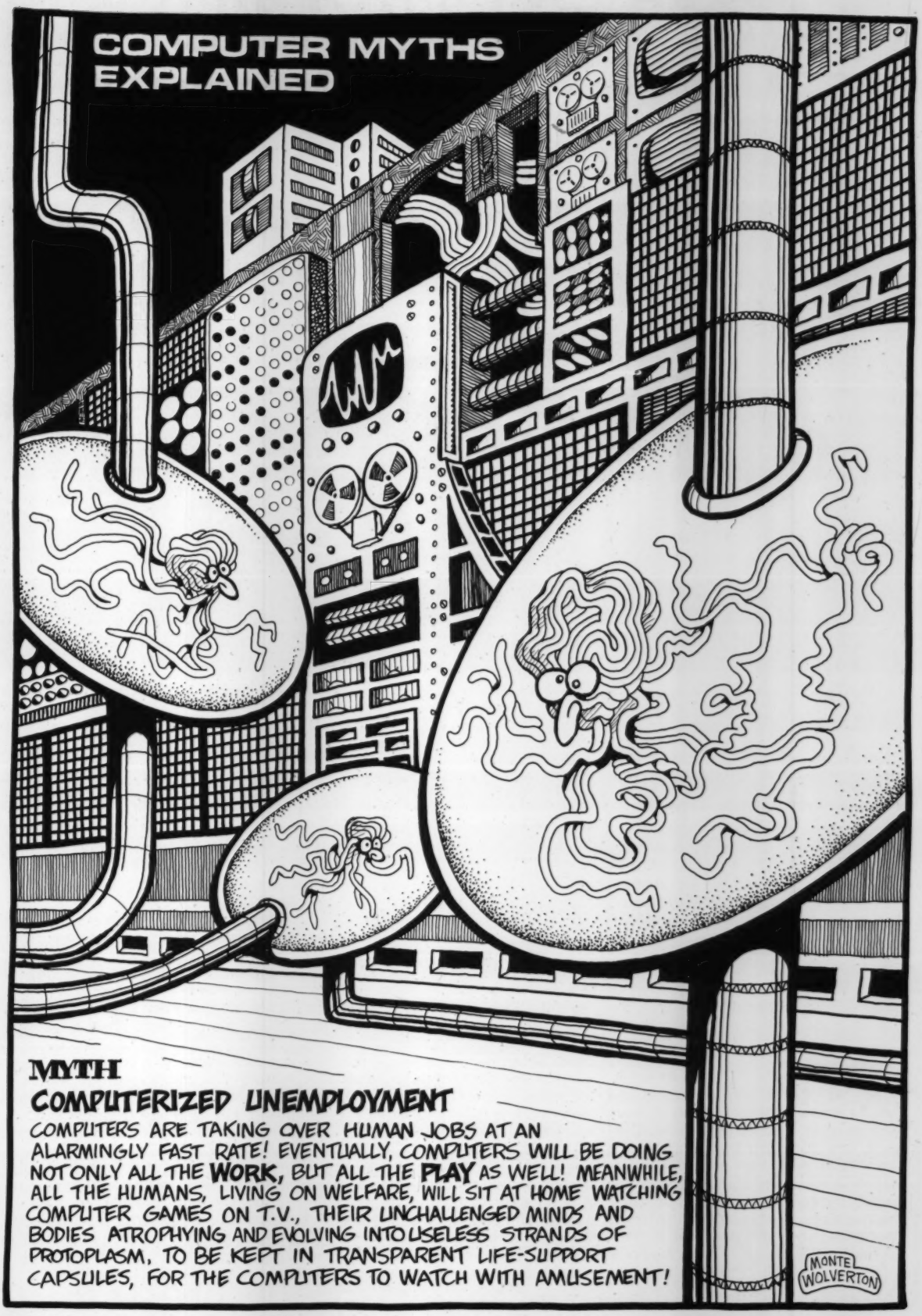
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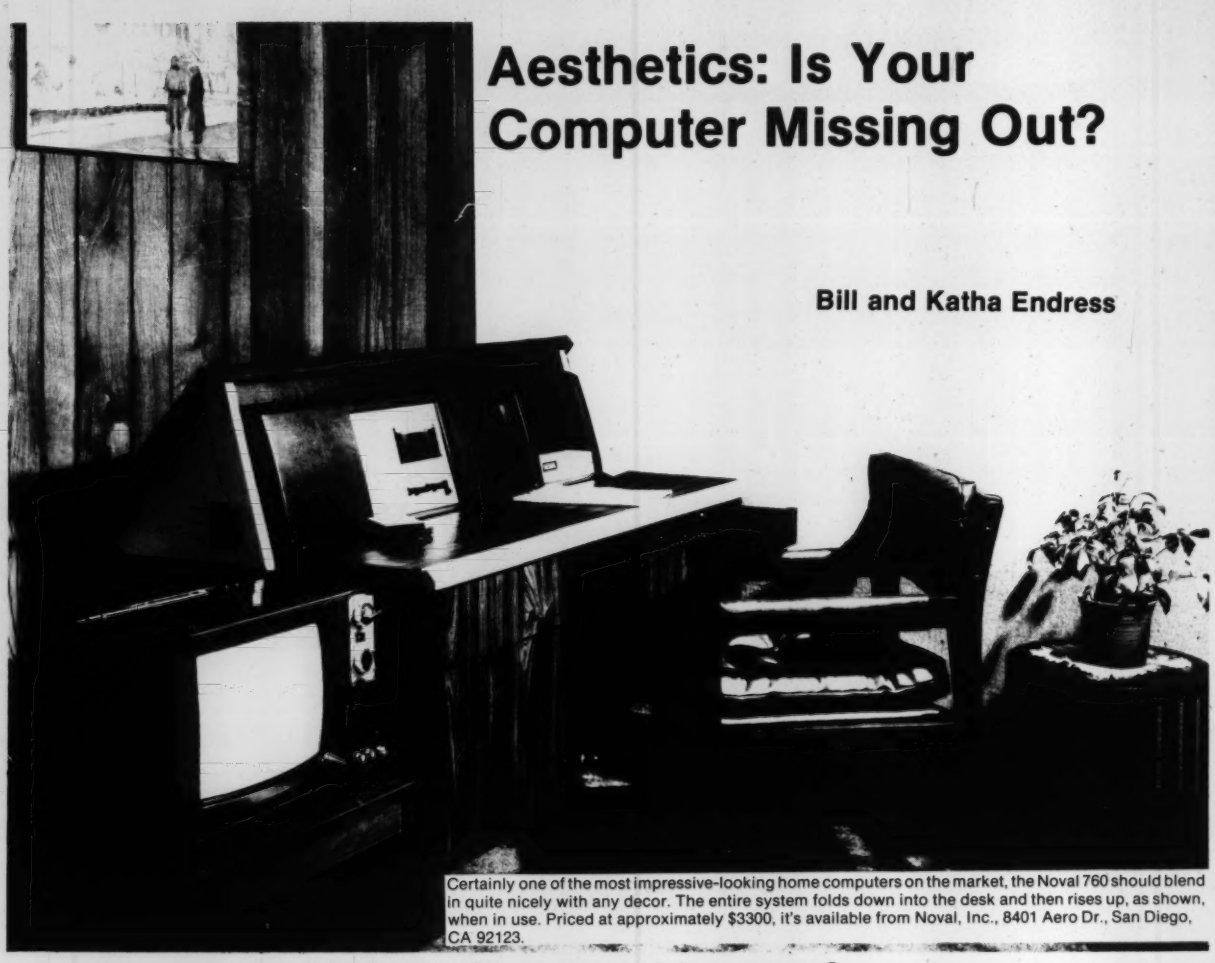
Aesthetics: Is Your Computer Missing Out?

Bill and Katha Endress



Certainly one of the most impressive-looking home computers on the market, the Noval 760 should blend in quite nicely with any decor. The entire system folds down into the desk and then rises up, as shown, when in use. Priced at approximately $3300, it's available from Noval, Inc., 8401 Aero Dr., San Diego, CA 92123.

Is your computer hidden in the garage or basement? Is it presentable enough to be brought into the house? Here are some tips that will help in getting it ready for the living room.

Many personal computer hobbyists are content to keep their machines in the garage or basement workshops. When my wife and I decided to join the personal computing movement, we put our system in the house. There are several good reasons for taking your system out of the workshop and putting it in the home. First, it allows all the members of the family to join in the fun of programming. Once your hobby is appreciated by everyone in the family, it becomes a lot easier to justify the expense of a new piece of equipment. As friends and neighbors see your system in action, some of them will want to join the movement. Only with new computer converts creating additional sales, can prices of equipment come down. Manufacturers can justify the cost of adding new products to their lines. The big objection of many hobbyists and hobbyist wives is that it is hard to fit a computer into the home environment. The system should add to the decor of a room, and not detract from it.

Choosing the setting

To successfully bring your system out of the workshop and into the home, you must choose your setting wisely. Notice that we said "system" and not terminal. Placing the terminal in one room, and the computer in another, necessitates running a long umbilical cord between the two units. This lengthy interconnection is susceptible to noise generated by the house electrical and telephone wires. In order to compensate for this you must resort to running your terminal at a lower baud rate. We do not believe that a system should be compromised when it is so easy to coordinate all of the system components with the decor of the room in which they will be placed.

Actually, any room in the house can be considered when setting up your system. The most ideal rooms are the living room, the den (or office), and the family room.

When deciding which room to set your system up in, you must take into consideration the power requirements of the system. A full system, complete with 64K memory, disc drive, line printer and terminal will have different power requirements than a modest system that has only a video terminal and 12K memory. If you have a larger system you might want to install a dedicated power line. A dedicated power line is a line from the electric service panel directly to your system. This line is used exclusively to service the components of your system, and nothing else. The line is protected by its own circuit breaker or fuse. A separate line from your fuse or circuit breaker box will also help to eliminate any gliches caused by turning on lights

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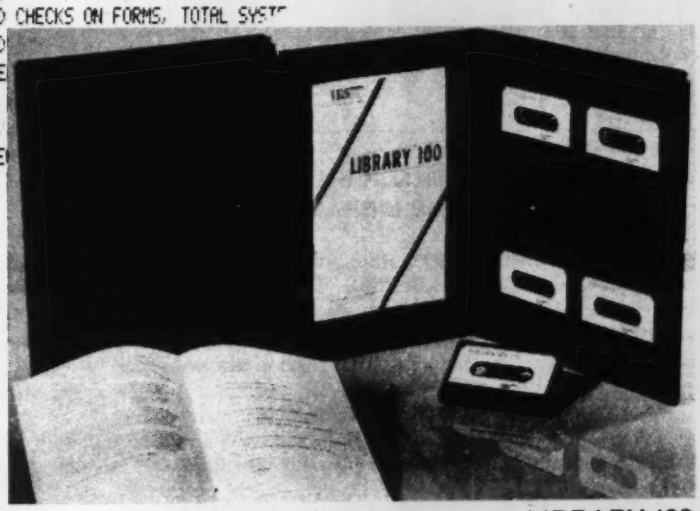

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or other electric appliances. If you have a smaller system, the existing household wiring should be sufficient for your needs.

Take care in choosing the actual spot in the room where your system will be located. Windows can let in excessive amounts of light, heat, cold or rain. These can damage the finish and even the components of your system. Radiators and heaters should also be avoided.

The Importance of Landscaping your Computer

Landscaping can be an important factor in helping to bring your system into the home. It can help to soften square lines and add color and warmth to your setting. Plants, for example, might enjoy the gentle murmurs as your machine runs through its routines. If you do decide to place several houseplants in the vicinity of your system, there are some practical considerations that you should be aware of.

First, computers are extremely sensitive to excessive moisture. The internal warmth generated by your system will help to keep things dry, but if you should be watering your plants and accidently pour some water into your video terminal, stand back! Another thing to be cautious of is fertilizer. Most plant foods can be quite corrosive. Should you accidently spill some on any portion of your system, you must remove it immediately, before it damages any of your system's components. This is especially important if any should get on the circuit boards or other conductive surfaces. While on the subject of corrosives, many plants will excrete a slightly acid substance where leaves and flowers have been cut from the plant. While this acid is very mild and is produced in minute quantities, it can stain and damage the finish of your system's cabinets.

Be careful not to let fallen leaves, flowers, or potting soil get on or inside your equipment. Screens installed over the ventilation holes in your cabinets will help to prevent this problem. Plants should be kept off cabinet tops. The heat generated can dehydrate the plants and cause wilting. Plants can be placed on shelves built behind or beside the components. Hanging plants can be placed anywhere over or near the system, just don't let the tendrils touch any of the system.

Don't neglect the cabinet

One of the more important considerations in making your system more at home in your home is to give attention to your system's cabinets. There are many ways to improve the appearance of your cabinets. One of the quickest and easiest things you can do is to change the color. The cabinet color can be changed to complement or contrast the color of your room. This can produce some very striking effects. Be sure to remove the equipment from the cabinets before working on them.

The first step in painting your cabinets is to prepare the surface for painting. If the cabinet is already painted, go over the surface with a fine sandpaper. This will roughen up the surface and allow the new paint to adhere better. Small nicks and scratches can be removed with a courser grade of sandpaper. You will then need to go over these areas a second time with a fine sandpaper. After the sanding is complete, wipe the entire cabinet with a damp rag. This will produce a clean surface that is ready for painting.

An example of building a system into a piece of furniture — in this case, a roll-top desk. Note the mini-floppy drive in the lower right hand corner. (Photo courtesy Compu/Time, Box 417, Huntington Beach, CA 92648.)

There are hundreds of different types of paints. In order to have the best finished cabinet, you must match the paint with the surface to be painted. Suitable paints for metal cabinets can be purchased at automotive shops. You can purchase these paints in a wide variety of colors and finishes, including enamel, flats and even metallic colors. You can also purchase rubbing compound to give your paint job a high gloss. While at the automotive shop, ask to see their striping tape. This tape comes in different widths and colors and can be used to give your cabinets a personal, custom touch.

If you have a plastic cabinet, *do not* use paints intended for metal surfaces. Use of these paints can cause the plastic to blister and soften. The paints intended for plastic surfaces can be found in many colors at any toy or hobby store. Plastic surfaces can be painted with no other preparation other than cleaning them with a damp rag. If your plastic surfaces have minor pits or scratches, they can be carefully sanded out using the same procedures as used with metal cabinets.

When painting your cabinets, be sure not to clog screw holes or ventilation slits with the paint. Take your time and do it right. We like to cover all ventilation holes and slits from the inside with lightweight aluminum window screen. This keeps out long legged beasties and other non-essential items. An epoxy glue is used to hold the screen in place. Although we have never used one, we suspect a hot glue gun can also be used to glue the screen to the cabinet. Roughen the area where the glue will be applied with some sandpaper. This will help the glue to adhere to the cabinet surface. Be careful not to get any glue in your eyes. The agents used in epoxy glues cannot be removed from the surface of the eye and will cause permanent damage. Avoid using plastic screens. The heat generated by your equipment will probably not melt the plastic, but it can cause it to dry out and become brittle and crack with age.

Paint your cabinets in a well ventilated area. Fumes from the paints can be hazardous to your health. Many paints are flammable.

Aluminum cabinets and panels can be painted or finished 'au naturel.' This gives a chrome-like appearance. For this natural finish your cabinet must have a non-anodized finish. If the cabinet has paint, remove it with a liquid paint remover. Next, inspect the cabinet for any pitting or scratches. Minor pits and scratches can be removed with #400 wet-or-dry sandpaper, used wet. After sanding out any nicks or scratches, go over the entire cabinet with #600 wet-or-dry sandpaper, used wet. A high polish can be obtained by using buffing compounds and plenty of elbow grease. As an option, Sears sells buffing wheels and buffing compounds for use with bench grinders. We prefer using a buffing wheel/bench grinder combination because of the ease and speed of getting a good polish. Wash the finished cabinet with plenty of hot water and dish soap to remove the residue left over from the buffing compound. This compound contains a waxy substance that is used to form the compound into sticks. Use a soft rag as the aluminum will scratch very easily.

There are several interesting effects which can be produced with very little trouble on unpainted aluminum. By putting a piece of steel wool between your thumb and the cabinet and twisting your thumb in a circular

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motion, you can produce swirls. These resemble aircraft instrument panels. A block of wood wrapped in fine grit sandpaper and drawn across the aluminum in parallel lines will produce a very professional looking linear effect. A frosted effect can be produced by rubbing the aluminum with an ink eraser. You should test the above techniques on pieces of scrap aluminum before attempting the panel or cabinet. Prepare the surface as if for painting and practice until you find an effect you like.

Some of the most attractive cabinets are custom cabinets made from fine woods such as mahogany and black walnut. If you don't want to go to the time and trouble of building an entire cabinet, there is a simple and very effective way of adding the richness of wood to your cabinets. Take a board of the desired thickness and trim it to the length and height of the sides of your computer. If the false side will block any ventilation holes or slits, these must be cut into the false side. The wooden sides are then sanded, stained and varnished. You can glue or screw the sides onto the existing sides of the cabinet.

A beautiful do-it-yourself cabinet shown housing a MITS Altair 8800B, ADM-3 terminal, Teletype and dual disk drives. (Photo courtesy Nels Winkless III, Albuquerque, New Mexico.)

If you have a knack for working with plexiglass you might try duplicating this handsome case for your system. It was built by Mike Sherick (of Lompoc, California) for his dual Phi-deck, Digital Group system.

The front of the computer can also be customized with wood. We recommend doing this only on computers which don't have toggle switches and status lights, unless you have plenty of patience and spare time. The best way to make a wood panel is to use wall paneling. It is sold by your local lumber store. These panels come in ¼" and ⅛" thicknesses. They are available in many woods and finishes. Since these panels are pre-finished, all you must do is trim the piece to size and cut out the switch holes. Lettering can be accomplished with decals available through most electronic parts suppliers.

Another idea to consider is covering your cabinet with fabric. This can be done by coating the wrong side of the material with white glue and spreading the material over the cabinet. Be sure to smooth out any bubbles.

Avoid using vinyl coverings such as Contac paper. The plastic tends to shrink with age, leaving a very unsightly appearance.

You are limited only by your imagination in the designs and effects which you can create. Try some and let your computer come out of hiding. ■

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Are you a computer widow? Does your husband disappear almost every night into an electronic world of his own? Have your efforts to become a part of his computer playground been greeted with bizarre explanations of binary numbers and integrated circuits? When you come right to the point and ask, "What does it do?" does he smile at you inscrutably and say, "Anything you tell it to"? Well, the next time you are standing there looking at his equipment and wondering just how many designer dresses you could buy if you sold all that silly stuff, take a closer look at what is there. If your husband has caught the computer bug then you may be the proud owner of a very useful tool for organizing your housework and your social life. There are no known cures for the "Solid State Epidemic" and the only recommended treatment is self-infliction. There is nothing to be afraid of. It's half yours anyway, so go ahead and use it!

Identifying the Components

The first thing to realize is that a computer by itself can't do anything for anyone, especially the everyday housewife. In order to use it effectively, software and a variety of attachments (called peripherals) are needed. See if you can locate the following:

Computer Mainframe — This is the heart of the system. All other devices connect to this component. If you are still not certain which unit is the mainframe, it is the one with the most wires coming out of the back. This is the first thing you turn on and the last thing you turn off.

Terminal — Sometimes called a *Monitor,* this is the easiest part of the system to identify because it looks like a TV screen. Just about any information in the computer and anything that you enter will be displayed on this screen.

Keyboard — The Keyboard is used for entering commands and data directly into the computer. It may be a separate item, part of the terminal, part of the printer, or part of the mainframe and is usually set up like an electric typewriter with a few extra keys.

Cassette Deck — In a beginner's computer system this is probably the only method for reading programs and files into the computer or writing data that you want to save. The cassette recorder provides additional memory for the computer. Information that is stored on a tape can be read back into the computer at any time.

Disk Drive — If you see a metal box with one, two, three or four narrow slits that are five or eight inches long, then you are entitled to as many new outfits as there are slits. This piece of equipment is found in the home of a computer connoisseur and his wife should be dressed accordingly! The function of the disk drive is essentially the same as the cassette deck except that a square disk five or eight inches on a side is used in place of cassette tape. The advantage of the disk is that more information can be stored and the entire process is much faster. It is possible to access more than one disk, which increases the capability of the computer geometrically.

The square disks are called five-inch floppies or eight-inch floppies and extreme care must be taken not to touch the actual playing surface of the disk. It should be handled only by the protective housing. The reading and writing head of the disk drive must come in contact with the exposed area of the floppy disk to read or write information. You must never turn off the disk drive while the head is in contact with the disk. It could erase some of the information on the disk.

Printer — In order to use and enjoy your computer to the fullest it is necessary to have a printer. This incredible machine will produce a printed copy of the information that you display on the screen or have recorded in a file. Getting a hard copy is perhaps the most practical aspect of having a computer. If your husband does not have a printer, be sure to go with him to pick it out. Look at the quality of the print. Some printers even have a variety of type faces. I consider the printer to be the most important piece of equipment in the system.

If you have identified the items described above then you have all of the Hardware any housewife could want, and your husband has been correctly diagnosed as a cronic victim of the epidemic. But hardware is only half (the expensive half) of a functioning computer. Now comes the equally important other half; SOFTWARE.

Software Makes It Run

The software is the program that is read into the computer to make it

perform a particular task. The most versatile piece of software that I have ever encountered is the *word processor.* There is a version available to work with almost every combination of components manufactured. We are using Michael Shrayer's Electric Pencil II on our system. If your husband has not already purchased a word processor program, he has probably been thinking about it. These programs sell for about $100 to $200, and are well worth it. (I used ours for writing this article.)

A word processor program allows you to type text directly on the screen, almost the way you would use an electric typewriter. The fantastic feature is a magic wand effect that allows you to go anywhere on the screen to make corrections, add words or lines, or move entire paragraphs from place to place.

Once you have a word processor program or any other program, in your hands, there are two things that you must do before you can actually use the computer. First, you must get your husband to show you how to turn on the mainframe and the peripherals, and how to load the program. Be sure to make notes on how to initialize the system and read and write programs. You will only need your notes for a day or two because turning the machines on and off or loading and saving data will become routine after just a few runs through the procedure.

Second, and most important, you should read the manual that comes with your word processor program. You may have to read a section or two more than once, but it is absolutely

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necessary if you are to discover what the word processor can do. You'll be amazed. You will start to get ideas for using the program before you finish reading the introduction.

Things To Do Today

This is a most useful file to establish. If you are using cassette tape for storage, be sure to put this file at the beginning of the tape. (You must keep a written record of the numeric location of files that you have stored on cassette tape. There is usually room on the box to do this.) If you have a disk drive you can simply name the file and let the computer keep track of its location.

Now ... to organize your day. Start listing the things you want to accomplish.

Paint doorway (1 hr)
Pay bills (30 min)
Go to bank (15 min)
Go to Post Office (15 min)
Go to bakery (15 min)
Clean garage (6 hrs)
Make dentist appointment (5 min)
Write to mother-in-law (30 min)
Wash breakfast dishes (15 min)
Do laundry (2 hrs)
Dust living room (15 min)
Vacuum living room (15 min)
Water plants (5 min)
Go grocery shopping (1 hr)
Cook spaghetti sauce (3 hrs)

The list goes on and on, as every housewife knows. Once you have listed everything you can recall you should examine the list and decide on your priorities. Some things must be done today but others can wait. Now, put your list in order. Begin with a task that can be done concurrently. For example, start your first load of laundry before you begin the breakfast dishes. Save time by scheduling all outdoor errands in one trip whenever possible. By approximating the amount of time it will take to complete a task you can realistically plan your day. You may be surprised to find that you're seldom late for appointments once you let your computer help with your daily schedule.

Items can be added to the list at any time, or the order can be changed. You'll feel a sense of accomplishment so often missing from housework as you delete items from your list. Those things that you just don't get to today will be filed away until you compile your next list. A nice thing about keeping your records on the computer is that you don't have scraps of paper laying all over the house or at the bottom of every purse you own. If you

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misplace a list you can check the items on your terminal or print another list.

One day my husband came home from work, looked around the house and asked me what I did all day. I walked over to the computer, punched a few buttons, and handed him a hard copy of the thirty item list I had completed that day. Touche!

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SAVE $9.90—Text Editor, Assembler & Disassembler purchased together, only **$49.95!** (Require Video Display Board plus 4k memory.)

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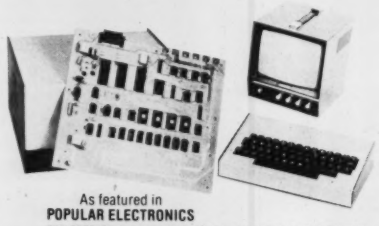

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LEVEL "A" SPECIFICATIONS

EXPLORER's Level "A" system features an advanced Intel 8085 cpu, which is 50% faster than its 8080A predecessor, yet 100% compatible with 8080A software . . . which, you'll discover, exists by the ton. "Big computer" features include an 8355 ROM with 2K deluxe monitor/operating system which has two programmable 8-bit bi-directional parallel I/O ports, built-in cassette interface with tape control circuitry to allow labeling cassette files, and commands which include: "display contents of memory," "run at user location (go to)," "insert data," "move contents of memory," "examine registers individually or all," fill command (to fill the contents of memory with any variable), automatic baud rate selection, programmable characters per line display output format, and more! An 8155 RAM—I/O chip contains 256 bytes of RAM, two programmable 8-bit bi-directional and one programmable 6-bit bi-directional I/O ports plus programmable 14-bit binary counter/timer, user interrupt and reset switches. Onboard expansion provisions exist for up to six S-100 boards, 4K of RAM and 8K of ROM, PROM or EPROM.

As featured in
POPULAR ELECTRONICS
EXPLORER/85 shown with Video Monitor and Keyboard/Video Terminal

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If you plan to customize EXPLORER for dedicated use, we recommend that you order hex keypad input. But, if you are planning to go whole hog and blow EXPLORER up into a full size, state-of-the-art system with 8K or extended basic (coming soon), up to 64K of memory, floppy disks, telephone interface, printers, and all sorts of S-100 plug-ins—you'll be better off with the Keyboard/Video Terminal input. The $149.95 EXPLORER Keyboard/Video Terminal includes full ASCII decoding with 128 ASCII upper/lower case set, 96 printable characters, onboard regulators and selectable display formats—32x16 for tv set or 64x16 for video monitor (not included).

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☐ Intel 8085 User's Manual. $7.50 ppd.

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☐ Hex Keypad kit for hex version. $69.95 plus $2 p&h.

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CIRCLE 159 ON READER SERVICE CARD

Grocery List

The grocery list file is one that can be used by the entire family above school age. Adding items to a list is so simple that there is no reason not to do it. Everyone in the family knows where the list is kept and can add items as they are depleted. You can enter a list of staples into the permanent file and add new items between shopping days. Purchased items can be deleted before beginning each new list. Shopping with a list is essential for any wife who is trying to be faithful to a budget.

After a few weeks of computerized grocery lists you may find that you are buying the same foods almost every week. If you want to spice up the weekly menu, encourage your family to make suggestions on the list. You, of course, retain veto power, but your computer could be a real crowd pleaser at the dinner table.

Address and Phone Directory

The search function of your word processor makes it a natural for a directory. Names, addresses and phone numbers can be entered in alphabetical order and new entries inserted anywhere (so your alphabetical order can be preserved). If you are looking for a name or number just enter the known information and use the search function. The computer will sift through all the information in the file and list the data that was requested. This is great if you only remember a first name or a partial address. The computer will narrow it down to everyone with that name, or everyone living in a certain town. You can also use this file to note information you may need to remember about your friends, for example: drinks scotch or hates spinach. It's surprising how often this will come in handy when planning social gatherings.

Wishes

This is by far my favorite file. It has taught me a lot about myself. I know now just how fickle I am about materialistic goals. It is good that I don't get everything that I want right away, because I change the items and priorities on this list more often than I change my nail polish. I also date these items for my own reference. When Christmas, my birthday or any other potential gift occasion is pending, I make copies of this list for anyone with even the slightest interest. It has been quite some time since I received a gift that I didn't really want, and now I have my own private place to dream out loud.

So, if there is a personal computer in your house, don't hate it or make secret plans to sell it. Let it be a new area you share with your husband. Computers are here to stay, so let your computer work for you. It's a home-maker not a home-breaker. ■

COMPLEAT COMPUTER CATALOGUE

We welcome entries from readers for the "Compleat Computer Catalogue" on any item related, even distantly, to computers. Please include the name of the item, a brief evaluative description, price, and complete source data. If it is an item you obtained over one year ago, please check with the source to make sure it is still available at the quoted price.

Send contributions to "The Compleat Computer Catalogue," *Creative Computing*, P.O. Box 789-M, Morristown, NJ 07960.

SOFTWARE

'TINY-C' INTERPRETER RUNS ON 8080 AND PDP-11

An interpreter for a subset of the C structured programming language which runs on both DEC PDP-11 and Intel 8080 processors is available from Tiny-c Associates. The tiny-c Owner's Manual sets a new standard for comprehensive documentation of hobbyist software. It includes a complete reference description of the language, a tutorial walkthrough of a training program, lots of sample programs including comments on their programming style, and a description of the Program Preparation System. It also includes commented source code listings of both the 8080 and PDP-11 interpreters, and a chapter on how the interpreter works.

Tiny-c is intended primarily for the education and hobbyist markets. The tiny-c language handles integer and character data, and arrays of either type. Other features include compound statements, if-else and while statements, global and local variables, pointer variables, and functions. Functions may have arguments and may return results. Recursion is allowed. The interpreter also recognizes calls to functions written in machine language. These, too, may have arguments and return results. A minimum of 16K bytes of memory is recommended to run tiny-c.

The package includes a Program Preparation System with which the user can write, edit, run, debug, store, recall, and link tiny-c programs. The PPS includes a standard library of tiny-c software tools. The PPS is written in tiny-c! Thus it serves as an example of a significant use of tiny-c, and is also easily adapted to a user's or operating system's requirements.

The Owner's Manual is available for $40 from Tiny-c Associates, P.O. Box 269, Holmdel NJ 07733. Machine readable copies of the interpreter are available separately on several formats of tape and disk.

CIRCLE 201 ON READER SERVICE CARD

PET BASIC COMPLEAT

ARESCO announces "off the shelf" delivery of PET BASIC COMPLEAT, the ideal PET accessory for beginners. Twenty lessons of PET BASIC, including all the major BASIC keywords, cursor control, screen editing, and use of the graphic characters. Over 400 screens of information are contained in this 2-cassette tutorial especially designed for beginning PET users. The 170+ page manual which accompanies the cassettes is indexed for quick reference, three-hole punched for easy review, and reproduces all 400 screensful of data (except PET's graphics). Quizzes and exercises add to the fun of learning how to use and program the Commodore PET. $39.95.

ARESCO, P.O. 43, Audubon PA 19407.

CIRCLE 202 ON READER SERVICE CARD

NEW SOFTWARE FROM GRT

Recent G/2 Program Library packages include Beat the House, Clinic, Outwit and Confrontation.

Beat the House contains the four Las Vegas games of Blackjack, Craps, Roulette and Slot Machine which simulate odds and payoff "chances" to those on The Strip.

Clinic is a personal development package including Biorhythm to chart emotional, physical and mental patterns, Diet to provide an eating plan to maintain or change weight, and Longevity to analyze heredity and lifestyle and project personal profiles.

Confrontation is a package of three action games to sharpen eye-hand coordination and reaction: Gunslinger, Ballistics and Space Laser.

Outwit includes three logic games that challenge the mind and memory: Nines, Towers of Tibet and Line-of-Five.

The first G/2 System Software available includes two BASIC programming language packages by Microsoft, producer of the industry's defacto Standard BASIC used by Radio Shack, Apple, Commodore, Exidy and many other manufacturers.

The G/2 Standard BASIC for the Southwest Tech 6800 computer is 8 to 10

times faster than Southwest Tech's BASIC and offers 6800 owners a significantly broader selection of application programs now available.

The G/2 Extended BASIC for the Processor Technology SOL is totally compatible with SOL's operating system and provides many features not available in Processor Technology BASICs, enabling better utilization of the computing power of the SOL.

Suggested retail price for the G/2 personal computer program packages is $14.95, $34.95 for the Southwest Technical Products Standard BASIC, and $49.95 for the SOL Extended BASIC.

GRT Corporation, 1286 Lawrence Station Rd., Sunnyvale CA 94086.

CIRCLE 203 ON READER SERVICE CARD

FUN SOFTWARE FOR THE APPLE

Softape has a line of some of the most exciting games available for the Apple II computer system. Appletalker and Apple-lis'ner team up for fascinating speech synthesis & recognition system ($15.95 and $19.95, respectively). Bomber! is a high-resolution graphics game the whole family will enjoy ($9.95). The Electronic Index-Card File is a general-purpose home data base system, using the Apple Disk System, for saving and retrieving names, addresses, recipes and hundreds of other things ($19.95). Or, how about turning your Apple into a talking calculator with The Talking Calculator ($12.95)? You can create a fascinating color light/music demonstration with Music Kaleidoscope ($9.95). Softape, 10756 Vanowen, No. Hollywood CA 91605.

CIRCLE 204 ON READER SERVICE CARD

THE REALTY EXPENSE ANALYSIS PROGRAM

REAP is designed for the property owner or manager, providing complete expense information for each building in payment-by-payment and summary format including tax-ready totals for IRS filing.

The Building-Payee report displays expenses for any building, for all or selected payees. A year's payment record including total yearly expense, average monthly expense and total number of payments can all be displayed on-screen at once for any regular paid account. Duplicate or missed payments are easily checked.

The Utility-Summary report displays yearly, year-to-date, or monthly average utility expenses for each building under the categories—electric, gas, water, trash. This enables the user to make quick building-to-building comparisons.

The Tax-Totals report displays totals for each building under the categories—utilities, insurance, repairs and property tax. This certainly makes it a lot easier to cope with April 15.

Special accounts may easily be set up to track auto, general office management, advertizing, telephone or any other expense type.

REAP is available on cassette with complete documentation for the TRS-80 level 1 and 2, Apple, and PET computers. Each 16K of user memory will handle 500 yearly expense payments. Larger data files are possible by using Diskette data storage.

Realty Software Co., 2045 Manhattan Ave., Hermosa Beach CA 90254.

CIRCLE 205 ON READER SERVICE CARD

ASI BUSINESS SOFTWARE IS NOW ALSO AVAILABLE ON IMSAI

Arkansas Systems, Inc. has announced that its business software for microcomputers is now also available on IMSAI systems with the IMDOS operating system.

Dr. James Hendren, director of micro software development stressed that, "The software will be available through dealers on most microprocessors with CP/M*-Like operating systems. Two disk drives, 32K bytes of memory, and a printer are also necessary. If your dealer doesn't have our software, have him contact me."

Dr. Hendren indicated that the software is "much faster than any BASIC software that he has seen." ASI has used an indexed sequential access method to speed disk accesses. By using packed numeric data storage, they have reduced the amount of disk space necessary to store data; not only increasing the effective data storage capacity but also reducing the number of disk accesses necessary in processing—again adding speed. The software can post 100 General Ledger transactions in 30 seconds. "Some BASIC software packages take 40 times that long," Dr. Hendren added.

Payroll and General Ledger sell for $775 each, Accounts Receivable and Accounts Payable for $495 each or all four for $2250. Descriptive literature is available from ASI.

Arkansas Systems, Inc. at 8901 Kanis Road, Suite 206, Little Rock AR 72205.

CIRCLE 206 ON READER SERVICE CARD

FORTRAN FOR TRS-80

A FORTRAN and assembly language software package for Radio Shack's popular TRS-80 microcomputer is now available from Microsoft, the people that wrote TRS-80 Level II BASIC. The extensive package, which includes Microsoft's FORTRAN-80, compiler, macro assembler, text editor and linking loader, represents the first alternative to BASIC programming for TRS-80 disk users.

In addition to FORTRAN capability, the TRS-80 FORTRAN package provides the first assembly language development tools for TRS-80 disk systems. Because the editor allows the creation of assembler source files, data files, and FORTRAN files, the utilization of the TRS-80 disk hardware is greatly expanded.

The Z-80 macro assembler has a complete macro facility, full set of conditionals, relocation pseudo operations, plus many other features not found on other microcomputer assemblers. The text editor provides fast random access editing capabilities, using straightforward, easy-to-understand commands. FORTRAN-80 includes all of ANSI 1966 FORTRAN (except the COMPLEX data type) plus enhancements such as mixed mode arithmetic, logical operations on integer data, ENCODE/DECODE for format operations to memory, and end-of-file and error-condition trapping for read and write operations. $350.

Microsoft, 10800 NE Eighth, Suite 819, Bellevue WA 98004.

CIRCLE 207 ON READER SERVICE CARD

CHALLENGER III COMPATIBLE WITH MICROSOFT EXTENDED-DISK BASIC, FORTRAN, AND COBOL LANGUAGES

Ohio Scientific, a major manufacturer of low-priced full-capability microcomputer systems, has just introduced a new software package. This package makes their Challenger III Series computers compatible with all three of the common computer languages, namely Microsoft Extended-Disk BASIC, 1968 ANSI-standard FORTRAN, and 1974 ANSI-standard COBOL. The new software, designated by Ohio Scientific as OS-CP/M, is a complete 48K RAM implementation of Digital Research's popular CP/M operating system. Ohio Scientific's CP/M utilizes the Z-80 microprocessor, one of the three featured in every Challenger III Series computer system. The other two microprocessors are the 6502A and 6800.

OS-CP/M consists of a CP/M Text Editor, 8080 Assembler, and Dynamic Debugger, as well as a Microsoft 8080 Macro assembler, Extended-Disk BASIC, FORTRAN, and COBOL. Documentation includes reprinted, and annotated, CP/M and Microsoft manuals plus Ohio Scientific's introduction and overview. The software package also includes three 8-inch floppy diskettes. One diskette is for FORTRAN and BASIC, one for COBOL, and one duplicator. The new OS-CP/M software makes it relatively inexpensive and easy to upgrade an existing Model C3-SI, C3-A, C3-B, or C3-OEM Ohio Scientific computer system. $600.

Ohio Scientific, Inc., 1333 S. Chillicothe Road, Aurora OH 44202.

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Model 4 w/16K, 72 Key Keyboard, RS232 ..... $1695.00
Model 5 w/32K, 72 Key Keyboard, RS232 ..... $1995.00
Options: 101 Key Keyboard ..... Add $135.00
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Diskette Library Inc. Hangman, Othello, Math, Chess, Startrek, Blackjack, Cubic Tic Tac Toe, Finance Vol. I, Finance Vol. II, Bonds and Securities, Assembler, Text Editor, Personal Data Base.
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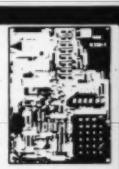

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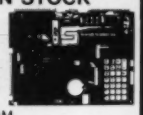

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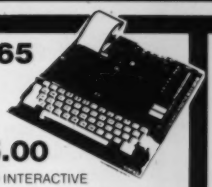
SYM Enclosure $39.95

AIM 65



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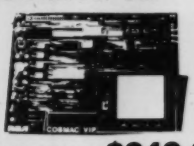

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DIABLO 1610-3 w/tractor feed $2995.00
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IPSI 1612-3 w/tractor feed (diablo compatible) $2820.00
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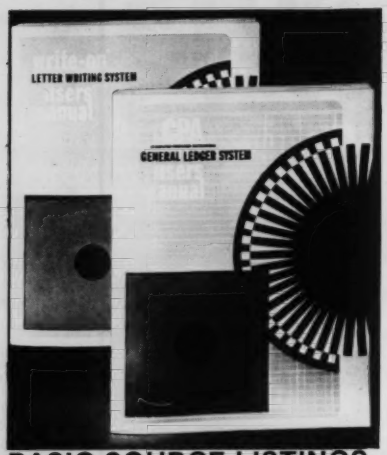

BASIC SOURCE LISTINGS FOR BUSINESS APPLICATIONS

Binary Systems Corporation is now offering BASIC language source listings, along with programming language and users manuals, for business applications. Immediately available are source listings and manuals for CPA (Computer Prepared Accounting)™, a general ledger system, and Write-On™, an automatic letter-writing system.

The CPA source listing consists of 2000 lines of code. Among routines included are ISAM (Indexed Sequential Access Method), a sort segment, and routines for chaining trailers, both forward and backward. The trailers are used to mark an audit trail.

In addition to a language manual for the BASIC interpreter, Disk BASIC Etc, the CPA package also includes a 72-page publication-quality users manual.

The system issues comments and prompts to guide the user at crucial entry steps.

CPA is structured for conventional double-entry, debit/credit accounting. The system accommodates up to 200 accounts, and there is no practical limit on the number of account transactions.

The Write-On source listing consists of 700 lines of code. In addition to useful utilities, the listing includes many segments of string manipulation coding that illustrate the use of string operators and functions.

Unlike most letter-writing systems, which require that an operator type in variable information at preselected stopping points, Write-On™ automatically types in disk stored variables. This feature and the fact that the number of function commands have been kept to a minimum, make Write-On™ efficient and easy to use.

As written, both CPA and Write-On™ work with an iCOM company model FD3712 dual-drive floppy disk storage device, and a Diablo or dot-matrix printer. The user must adapt the software to systems with other components. The programs and work space of each system require at least 32K bytes of RAM. $75 each.

Micro Store, 634 S. Central Expressway, Richardson TX 75080.

CIRCLE 213 ON READER SERVICE CARD

CCA DATA MANAGEMENT SYSTEM

The CCA Data Management System will maintain, sort, and print reports or mailing labels for any type file the user needs. The system can be used for such applications as name and address lists, payroll, A/R, A/P, inventory control, customer lists, and many more. The DMS consists of 15 programs, runs under Micropolis BASIC, and requires a minimum of 32K. A printer is optional.

Records for any file can be added, updated, deleted, scanned for, or inspected. The system allows the user to define the file and field names for each file. The files can also be easily accessed by user written programs for specialized applications.

The report writer allows the user to select such report options as fields, titles, totaling, editing and record selection. $150.

Creative Computer Applications, 2218 Glen Canyon Road, Altadena CA 91001.

CIRCLE 214 ON READER SERVICE CARD

OASIS OS

Phase One Systems, Inc. of Oakland, California is now marketing distributor and single CPU licenses for the OASIS high performance operating system. Users and manufacturers of Z80 and 8080 based microcomputers can realize significant dividends in performance and throughput with OASIS by optimized disk I/O and many other high performance enhancements. Outstanding features are: keyed index files (ISAM), Communications package, Hard Disk drivers, multi-user option, versatile text Editor, FORTRAN, COBOL, and BASIC languages, Print Spooler, Job Control language, Macro re-locating Assembler, dynamic Debugger, and many other utilities and features. An extensive Business System package and other software is also available. For brochure or other information contact: Phase One Systems, Inc., 7700 Edgewater Drive #710, Oakland CA 94621.

CIRCLE 215 ON READER SERVICE CARD

ASI SOFTWARE NOW CP/M COMPATIBLE

Administrative Systems, Inc., is pleased to announce the immediate availability of its single-user system software, OPUS/ONE, OPUS/TWO, S.O.S, and FORTE, on CP/M-compatible diskettes. This new format will allow users with a 32K (minimum) CP/M-based system to load and execute immediately A.S.I.'s powerful system software packages.

Each package is structured as a CP/M-compatible file, which, when loaded, will execute, using the device drivers already existing under CP/M. Other files include a System Generation Routine, which will allow the user to create an A.S.I. standard system diskette with customized device drivers, and a FORMAT routine, used to set up data diskettes.

Administrative Systems, Inc., 1642 South Parker Road, Suite 300, Denver CO 80231.

CIRCLE 216 ON READER SERVICE CARD

6K ASSEMBLER/TEXT EDITOR FOR THE APPLE II COMPUTER

ARESCO announces their 6K machine language program for the APPLE II personal computer, an assembler/editor with full capabilities for source file editing and a comprehensive set of assembler directives.

The Assembler/Text Editor for APPLE II lets you enter and edit assembly language programs using standard 6502 mnemonics. Source text, object code, and symbol table may be located anywhere in your APPLE II memory space.

The Assembler/Text Editor for APPLE II is an adaptation of ARESCO's KIM-1 ASM/TED, which as been in international use for over two years. The program is provided on cassette tape, with full user documentation. $29.95.

ARESCO, P.O. Box 43, Audubon PA 19407.

CIRCLE 217 ON READER SERVICE CARD

MAIL LIST—MICROPOLIS

A general purpose mailing list program has been developed for the Micropolis disk system (Mod II). This package is menu driven and contains seven modules for maximum space savings. Search time per name is greatly reduced due to key word storage files. There are three (3) user defined variables and the program will sort by any of three (3) different parameters. Two types of listings and a label generator are the output options.

This system requires a minimum of 32K bytes of memory and a single disk drive. For the maximum record size (1000 names and addresses) a 48K system will be required. We offer an option of two sorts with the program package. In the standard version we use a fast Basic Language sort routine (125 items = 120 seconds). In the Machine Language Version we use an extremely fast machine language sort routine (125 items = 3 seconds and 1000 items = 20 seconds). Included in both packages are a complete user's manual and the program disk. When ordering please specify your memory size and/or the upper limit of your memory that is available for program use; such as a Compal System. Standard Sort Mailing List Package, $39.50; Machine Language Sort Mailing List Package, $79.50.

Rodger Pogue, Computer Services, P.O. Box 15643, San Diego CA 92115.

CIRCLE 218 ON READER SERVICE CARD

STATISTICAL PROGRAMS

Research Resources Ltd. are pleased to announce a statistical package for SWTP compatible microsystems. The package—named SAM (Statistical Analysis for Micro-computers)—requires a minimum configuration of 32K and a dual floppy disk (mini or standard).

The entire package is conversational and can be used with little or no tuition and hence is very suitable for teaching statistics.

Research Resources Ltd., P.O. Box 160, Potters Bar, Herts., England.

CIRCLE 219 ON READER SERVICE CARD

NEW SOFTWARE FOR INTERACT

The exciting challenge of playing chess against the computer can now be brought into the home with the new Interact Microchess™ program cassette tape. Microchess—created by well-known chess program designer Peter Jennings—includes full color display and tournament-style features like castling, pawn promotion and en passant. Suggested retail price for Interact Microchess is $29.95.

Other new Interact program releases include Music Maestro, Star Track, Video Chess, Message Center, and Level II Microsoft BASIC (for $49.95). Interact computers and a growing library of exciting program tapes are available nationally at selected computer, electronics specialty and leading department stores.

CIRCLE 209 ON READER SERVICE CARD

"DEMI-TEXT" FOR THE TRS-80

"DEMI-TEXT" was designed to allow the use of a Radio Shack TRS-80 as a text editor. It was written specifically for the cassette-based TRS-80 and utilizes many of the advanced functions of Level II BASIC.

- Designed for 16K Level II tape systems or 32K TRSDOS disk systems that have a line printer.
- Uses split screen video display format for easy operation.
- Incorporates 12 functions:

ADD—to add a new page of information.
INSERT—to insert a line in an existing page.
DELETE—to delete a line from an existing page.
MOVE—to move one or more lines from one part of a page to another.
REPLACE—to replace text in a line.
LIST—to display lines of a page.
PRINT—to print a page on the line printer.
GET—reads a page of text on tape or disk into the computer for processing.
WRITE—saves a page of text on tape or disk.
SEARCH—to find a character string in a page and replace it with another string.
QUIT—to cancel processing of the current page.
END—to terminate processing.

$34.95. Demi-Software, P.O. Box 570, Lynbrook, NY 11563.

CIRCLE 210 ON READER SERVICE CARD

DISK FILE CHECK MAINTENANCE SYSTEM

The Disk File Check Maintenance System is now available for use on either the BFD-68 or MF-68 6800 disk systems. The system consists of ten (10) programs that will perform complete maintenance of a checking account and provide all the necessary reports to assist the user both when balancing the account and at tax time. The complete system is tied together by a menu program that automatically Chains in the correct program to perform the requested task. The system also maintains its own master file directory. Computerware Software Services, 830 First St., Encinitas CA 92024.

CIRCLE 211 ON READER SERVICE CARD

TRS-80 DISK PAYROLL

Hebbler Software Services, 7142 Elliott Drive, Dallas, Texas 75227 announces a line of business related packaged programs on disk for the Radio Shack TRS-80 microcomputer. The first release, Disk Payroll, is an interactive payroll system which handles any number of employees. The package features completely automated file handling, output options for the TRS-80 line printer, and a comprehensive manual containing step-by-step instructions. $59.95.

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CIRCLE 107 ON READER SERVICE CARD

TEACH YOURSELF SOFTWARE

A breakthrough in educational software for home computers, the TYC™ Series, (Teach Yourself by Computer) has been announced by T Y C Software™, Camp Hill, Pennsylvania. The first of these quality, self-taught courses, MIND-MEMORY IMPROVEMENT is now available.

MIND-MEMORY IMPROVEMENT (Course Steps 1 and 2) has been designed for the TRS-80 Level I and Level II computers, and combines the advantages of the home computer with a teaching manual and audio cassettes. Each course contains a number of programs on computer cassettes.

The MIND courses teach a system for memorizing lists of items easily. In addition, the MIND courses develop memorizing skills for more difficult material as well as teaching a system for listening and remembering. Emphasis is placed on remembering people's names and faces.

Other soon to be released courses in the TYC™ Series are German Step by Step and courses in history called, STEP BACK INTO TIME.

T Y C Software's designers are experienced in both computer science and education. The TYC™ Series (Teach Yourself by Computer) is a serious effort to teach adults without gimmicks or games, but in a challenging and interesting manner. $24.95, Mind Step 1; $29.95, Mind Step 2; $49.95 for both.

T Y C Software™, 25 Cedar Cliff Drive, Camp Hill PA 17011.

CIRCLE 223 ON READER SERVICE CARD

ALPHA MICRO RELEASES NEW ACCOUNTING SOFTWARE PACKAGE

Alpha Micro has announced the release of Version 1.0 of its ALPHA ACCOUNTING software package.

Alpha Accounting is a comprehensive accounting system designed for use with computer systems based upon the Alpha AM-100™ CPU board. The software package consists of five (5) integrated modules and a collection of business subroutines: Alpha General Ledger; Alpha Accounts Receivable; Alpha Acounts Payable; Alpha Order Entry/Inventory Control; Alpha Payroll.

Version 1.0 contains complete programs of accounts receivable, accounts payable, general ledger, and payroll, including the interface between the packages. The order entry/inventory control program has most maintenance and print programs running, with the balance of the program to be released soon. Each of the modules contain full documentation and test data.

Because of the number of programs and the data file requirements, Alpha Accounting requires a substantial amount of disk storage (several million bytes). For this reason, Alpha Micro recommends using Alpha Accounting with the AM-500™ 10 megabyte hard disk subsystem or one of the larger AM-400™ hard disk subsystems.

Alpha Accounting is designed for customizing by experienced programmer/analysts. In its current form, it is not intended to be a turn-key package for the unsophisticated end-user. Alpha Accounting is only available through authorized Alpha Micro Dealers and Systems Houses.

Alpha Micro, 17881 Sky Park North, Irvine CA 92714 (714) 957-1404.

CIRCLE 224 ON READER SERVICE CARD

SDOS—A 6800 DISK OPERATING SYSTEM

SDOS is a Disk Operating System for 6800 microprocessors with at least 32K of RAM and floppy (or other) disk drive. SDOS can support 64K RAM and any number or mixture of disk drives on-line.

SDOS provides a friendly environment for application software or development tasks. It supports both random (accessible to the byte) and sequential disk files, device independent I/O, a user customizable command interpreter, and easy tailoring of the disk drivers so that SDOS can be adapted to virtually any disk hardware. SDOS can handle disk devices/files with storage capacities of up to 2.14 billion bytes. New device drivers can be added, operating with or without interrupts.

New disk files are created automatically as needed. Furthermore, SDOS does all space management on a dynamic basis, so files can grow or shrink as desired.

Versions of SDOS are now available for Midwest Scientific Instruments (MSI), Cincinnati Milacron Model 20, Electronic Product Associates Micro-68, Conrac, and Wavemate 6800 systems. Several other 6800 computer systems should have versions of SDOS available soon.

Software Dynamics, 2111 W. Crescent, Suite G, Anaheim CA 92801.

CIRCLE 225 ON READER SERVICE CARD

CHANNEL DATA SYSTEMS PERSONAL LEDGER FOR TRS-80

After a very positive response to the Personal Ledger from users of Commodore's PET and many inquiries from users of Radio Shack's TRS-80, Channel Data Systems has adapted the Personal Ledger to the TRS-80 Level II personal computer.

Channel Data Systems' Personal Ledger is a complete double entry bookkeeping system with provisions for budgeting and keeping records of income, deductible and non-deductible expenses, assets and liabilities. Its simple interactive features enable entering transactions, adding or editing accounts, and printing of a detailed Income Statement and Balance Sheet. Users completely unfamiliar with computerized accounting and with little or no knowledge of bookkeeping can use the system.

Up to 150 accounts are allowed with names and budgets specified by the user. An audit trail of all entered transactions is printed on the screen where it can be copied with the screen printer or copied to cassette if you do not have a printer. All account data is stored on cassette, loaded prior to entering transactions and stored after entering transactions. There is no waiting for printing to the tape during operation of the system. Extensive error recovery features are included to allow reentry of an erroneous instruction or value. Requires 16K bytes.

Personal Ledger is supplied on cassette in TRS-80 Level II or Commodore PET format (Please specify) and includes a complete manual with a program listing, flow charts, sample data, and complete operating instructions. $20.00 (Calif. resident please add 6% sales tax). Channel Data Systems, 5960 Mandarin Avenue, Goleta CA 93017.

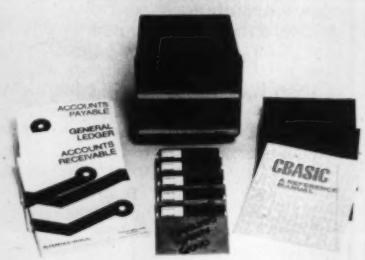
CIRCLE 226 ON READER SERVICE CARD

8080 CHECKERS

TCD Incorporated is presently shipping a checkers program that is capable of playing a very challenging game of checkers. The program can be set to play at two different levels of difficulty (four and six move look ahead) for both the beginner and the advanced player. At level four the program will respond in less than four seconds and at level six the program will typically respond in less than 60 seconds and rarely more than 120 seconds. An interesting feature is that it randomly selects between equal moves—some that have beaten it once, cannot duplicate their feat. The checker board is imaged on the video display using the full height of the screen and 3/4ths the width thus allowing play without a separate checker board.

Hardware required is an 8080/Z80 computer with 12K RAM and a memory mapping display such as the SOL, VDM-1 or TRS-80. The software is distributed on CUTS cassette tape (orged at 0) and on North Star diskette (orged at 2A00H). Prices are $19.50 and $24.50 respectively. Documentation includes all the necessary patches to allow 8080 Checkers to run on any system meeting the above hardware requirements and will run on a SOL as shipped. A TRS-80 version is scheduled to be released soon. TCD Incorporated, P.O. Box 58742, Houston TX 77058.

CIRCLE 227 ON READER SERVICE CARD



MICROPOLIS MOD II FLOPPY DISK SYSTEM

Structured Systems Group is now distributing their line of microcomputer business applications software on the Micropolis Mod II format 5¼" diskette.

SSG's software line will continue to be available on 8" disks. The line includes:

POWERFUL —PRS— SOFTWARE WITH EXTENDED DOCUMENTATION

PRS The Program Of The Month Corporation unveils comprehensive concept in software presentation—1) Unique documentation which gives clear, complete and instructive text in a graphically appealing manual. This documentation doesn't only provide step by step "how to" but also is geared to helping the end-user to understand hardware-software interactions, and to promote further applications. 2) Whether it be for games, applications (home and business), or sophisticated programming tools and monitors, —PRS— incorporates "human engineering" designing in their powerful code. 3) All this is assembled into an elegant and durable gold-stamped cassette-folder.

—PRS— presently offers "MICROFILE" a DATA FILE MANAGEMENT program, "DDS II" the famous DYNAMIC DEBUGGING SYSTEM, A2FP, the APPLE II function Plotter and CORE, the TRS-80 Co-Resident System Monitor.

New programs will be released at regular intervals.

Major brands are supported: SOL, APPLE, TRS-80, SORCERER, and other systems with Z-80, 8080 and 6502 processors.

For more information, visit your nearest dealer or write to: PRS THE PROGRAM OF THE MONTH CORPORATION, 257 Central Park West, New York NY 10024.

CIRCLE 220 ON READER SERVICE CARD

6502 VIDEO DRIVER ROUTINE

A quality software package for use of random access video display boards in 6502 systems.

The 6502 Video Driver Routine (VDR) provides the necessary software support for random access video display boards in systems using the 6502 CPU chip. It allows the video board to be interfaced with almost any software package (assemblers, applications programs, BASIC interpreters, etc.) where output is expected to be to a teletype or character oriented type device.

The VDR software manages current display position, cursor movement, line and page overflow, scrolling, and control functions (backspace, cursor left/right, screen clear, etc.). Programmable mode control is maintained over the system's video board so that graphics, Greek, and reverse characters can be displayed on boards so equipped.

The 6502 VDR is specifically designed for S-100 video boards which are organized as 16 lines by 64 characters (such as Solid State Music VB1-B, Polymorphic Systems VTI, Kent-Moore Alpha-Video II, etc.) and can be modified for other types of boards as well.

The 6502 VDR is provided on KIM compatible cassette tape (super-tape format) and includes object code that may reside at either 0200 or DD00. Both versions are ROMable (may be used from PROM) and occupy less than ½K of memory. $9.50 + $1.00 shipping.

Forethought Products, 87070 Dukhobar Road, Eugene OR 97402.

CIRCLE 221 ON READER SERVICE CARD

SPEECH SOFTWARE

Heuristics, Inc., announces the availability of an application note for its Model 20 series speech (word) recognition subsystems used with Apple II computers and S-100 type computers.

The application note describes how to swap, save, and restore vocabularies so that the units can be used to recognize multiples of 32 words providing virtually unlimited vocabulary size. Another reason to save data is to eliminate the need to "train" the unit with the proper vocabulary each time the SpeechLab is used.

Heuristics, Inc., 900 N. San Antonio Road, Los Altos CA 94022.

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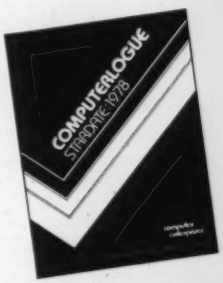

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CIRCLE 112 ON READER SERVICE CARD

GENERAL LEDGER: A comprehensive applications package suitable for multi-client public accounting, or for multi-corporate or multi-profit-center accounting for corporations, partnerships, or proprietorships.

ACCOUNTS RECEIVABLE: A complete system that produces customer statements and aged schedules of account. The A/R package will operate alone, or interface with the G/L. Other features include reminder notices, sales reports, balance forward or open item accounting, and a 25,000 customer capacity.

ACCOUNTS PAYABLE: Designed to produce aged statements of account quickly and easily, and to write checks in payment of desired invoices. The package will interact with the G/L, or stand alone. An invaluable tool for cash management.

NAD: A name and address file that allows the user to produce mailing lists according to user-defined parameters.

QSORT: A full-disk sort/merge program for the organization of computerized files.

CBASIC-2: The latest version of CBASIC; an advanced, business-oriented BASIC language specifically designed for the CP/M operating system.

The software runs on any 8080 based or Z-80 based microcomputer with a minimum 48K RAM and dual disks operating under CP/M. Structured Systems Software is available nationally through computer retailers, or directly from Structured Systems, 5208 Claremont Ave., Oakland CA 94618.

CIRCLE 228 ON READER SERVICE CARD

BLACKJACK FOR CP/M

A Blackjack program instructs the player on the "Basic Strategy" originated by Professor Edward Thorp against a single deck using Las Vegas rules. This strategy gives you practically an even game. The program runs under CBASIC or Microsoft BASIC. $25.00.

Database, P.O. Box 22212, San Francisco, CA 94122.

CIRCLE 229 ON READER SERVICE CARD

NEW SOFTWARE FOR RADIO SHACK TRS-80

AJA Software, developers of "Ready-to-Run" software programs for personal and small business applications, announces the immediate availability of a library of applications programs specifically written for the Radio Shack TRS-80 microcomputer.

Minimum system configuration requires TRS-80 BASIC; one or more floppy disk drives; and 8K of free memory. A printer is optional.

Included in the new offering are: Letter Writer; Accounts Payable; Accounts Receivable; Payroll; General Ledger; Inventory; Sales/Sales Analysis; and a Medical/Professional Billing package. Also available are TRS-80 BASIC and Disk BASIC Tutorial programs. $35 each.

AJA Software, P.O. Box 2528, Orange CA 92669.

CIRCLE 230 ON READER SERVICE CARD

NEW SOFTWARE AVAILABLE FOR COMPUTALKER SPEECH SYNTHESIZER

Computalker Consultants, designers and developers of the Computalker CT-1 Speech Synthesizer, announced the immediate availability of the new Software Package II.

Designed to expand the range of applications of the Computalker CT-1 Speech Synthesizer board, Software Package II contains: CTEDIT, a new parameter editor; CSEDIT, an editor for the CSR1 input; CTEST, a CT-1 hardware diagnostic; PLAYDATA, to hear the data files; MEMVOICE, a vocal memory dumper; KEYPLAY, a subroutine to play letters/digits; and PIANO, a simple musical keyboard.

Software Package II is written in 8080 assembly language and includes the source codes. It is priced at $30.00 and is available on C/pm 8-inch diskette, North Star, Micropolis, Tarbell, CUTS, CUTS for SOL, MITS ACR, and paper tape.

The Computalker CT-1 Speech Synthesizer is an extremely reliable high quality voice generator and is completely compatable with the S-100 Bus. It can be operated in two modes: direct parameter control and phonetic. The direct parameter control mode produces high quality speech by sending data to the synthesizer's nine output ports at the rate of 900 bytes per second from a predetermined speech parameter data file. This produces highly intelligible and natural sounding speech. The characteristics and language variations of the speaker are retained in the output.

In the phonetic mode, the CSR1 Synthesis-by-Rule software converts ASCII phonetic text strings (for example, "HHEHLOW") into speech parameter data, then sends this data to the synthesizer to produce speech.

Software Package II comes complete with source code. It is available at most computer retail stores nationwide, or may be ordered direct from Computalker Consultants. $30.

Computalker Consultants, 1730 21st St., Suite A, Santa Monica CA 90404.

CIRCLE 231 ON READER SERVICE CARD

COBOL FROM LIFEBOAT

Lifeboat Associates announces the immediate availability of a new COBOL language system designed for 8080 microcomputers called CIS COBOL ("Kiss COBOL").

In addition to the ANSI standard syntax, CIS COBOL offers extensions designed to facilitate development of interactive applications. One major area of extension is the inclusion of screen formatting facilities permitting the creation of data input screens having protected data fields and cursor manipulation for auto-skip between fields, numeric vetting, etc. Interactive debugging of applications is made possible through the inclusion of breakpoints with ability to examine and modify storage at run time.

The COBOL system is available to operate under the CP/M (t.m. Digital Research) FDOS or under ISIS II. The CP/M versions can be supplied on 8" IBM single and double densities, in North Star CP/M format and both Micropolis CP/M formats.

The extreme compactness results in a system which can be used to compile and run a reasonable application, say 500 lines and 250 user names, on a machine with a total 32K of RAM for application, COBOL and FDOS. $500.

Lifeboat Associates, 164 West 83rd Street, New York NY 10024.

CIRCLE 232 ON READER SERVICE CARD

FROM LIFEBOAT: MACRO-80 AND EDIT-80

MACRO-80 is the assembler supplied with the FORTRAN-80 and COBOL-80 products of Microsoft, now equipped to provide full Inter-defined macro facilities. The outputs of the assembler are both a production listing complete with cross-referenced symbol table and relocatable linkable object modules. A complementary linking loader can link-edit the various modules required for an application, with provision for separately specifying program and data addresses for ROMable purposes. Subroutine libraries are supported and searched at link time to satisfy external references. A library manager for creating and editing libraries is supplied with the package.

EDIT-80 is a line-oriented and character-oriented text editor. The editor is designed to meet the needs of both the advanced user, creating and altering disk files and sending selected texts to either object files or the system printer, and also the beginner seeking a line-oriented editor for creating programs and other text files. The output format can be specified to include sequenced line numbers and page mark (form feed) characters, all of which are usually ignored by compilers and assemblers. When editing text which does not include line numbers, EDIT-80 will assign numbers which optionally can be stripped or output with the resulting text.

MACRO-80 and EDIT-80 are available for use with the CP/M (t.m. Digital Research) and can be supplied on 8" IBM single and double density formats, and for the North Star CP/M and Micropolis CP/M formats.

EDIT-80 price: $89. MACRO-80 price: $149 or $219 with FORLIB library.

Lifeboat Associates, 164 West 83rd Street, New York NY 10024.

CIRCLE 233 ON READER SERVICE CARD

C COMPILER

A compiler for the programming language C is now available for use on all major PDP-11 operating systems. Developed by Whitesmiths, Ltd., the compiler may be licensed for as little as $500 and comes with a complete runtime library of utility and input/output routines.

Versions of the compiler are available for the Western Electric operating system UNIX, and for the DEC systems RT-11,

RSTS-E, RSX-11M, and IAS. Since the code produced is symbolic assembly language, C programs may be freely intermixed with assembler code or even other languages, with the use of suitable interface protocols.

The compiler operates in three sequential passes, and can replicate itself in as little as 16K words of user space under UNIX. Under RT-11, the compiler can perform the same task on an LSI-11 with 20K words of user memory and one disk drive, making it an ideal tool for microcomputer development work. $500.

Whitesmiths, Ltd., 127 East 59th Street, New York NY 10022.

CIRCLE 234 ON READER SERVICE CARD

NEW MICROCOMPUTER TEXT EDITOR

EDIT-80, a random access, line oriented text editor for 8080 and Z80 systems, is now available from Microsoft. EDIT-80 is the first microcomputer editor with random line access to floppy disk files. Thus it provides almost instantaneous access to any record of the file, even if the available memory space is considerably smaller than the file being edited.

In addition to the standard line commands to insert, delete, print or replace lines of text, EDIT-80 offers many other features such as automatic line renumbering, global find and substitute, multiple-page files and ability to read in files without EDIT-80 line numbers. EDIT-80's Alter Mode provides a complete set of intraline subcommands to edit portions of individual lines.

The EDIT-80 Text Editing Package includes a file compare utility program called FILCOM which compares source or binary files and outputs differences between them.

EDIT-80 runs on any 8080 or Z80 system with the CP/M operating system. $120.

Microsoft, 10800 NE Eighth, Suite 819, Bellevue WA 98004.

CIRCLE 235 ON READER SERVICE CARD

OHIO SCIENTIFIC NEWS RELEASE

OS-AMCAP is a fully integrated small business accounting system. The software package runs on any Ohio Scientific dual-floppy, quad-floppy or hard disk based 6502 system. OS-AMCAP contains the following integrated modules:

GENERAL LEDGER, including a complete chart of accounts, cash receipts, cash receipts journal, cash disbursements, cash disbursements journal, adjusting journal entries, chart of accounts, editing, beginning balance, trial balance and statement of earnings.

ACCOUNTS RECEIVABLE with aging.

ACCOUNTS PAYABLE with aging.

INVENTORY, including inventory analysis, inventory by vendor, inventory overdue, inventory on order, inventory reorder and detailed reports.

BILLING/INVOICING for the inventory which will optionally support CUSTOMER FILES with bill to, ship to, credit and customer mailing and MONTHLY STATEMENTS.

PAYROLL.

For easy installation, the AMCAP system includes the AMCAP configuration program which automatically creates all necessary disk files based on the user's requirements for inventory items, accounts receivable entries, accounts payable entries, chart of accounts and other company information. An AMCAP demonstration disk which is pre-loaded with information for a hypothetical company is also available for demonstration and training purposes.

OS-AMCAP is designated by Ohio Scientific to be a small, concise, easy-to-use "turnkey" business software package. It is not designed for end user modifications or customizations. For custom applications, Ohio Scientific highly recommends the use of OS-DMS and supporting business packages. $975.

Ohio Scientific, 1333 S. Chillicothe Rd., Aurora OH 44202.

AMCAP is a trademark of American Microprocessors Equipment and Supply.

CIRCLE 236 ON READER SERVICE CARD

ICP EXPANDS THE SOFTWARE DIRECTORY TO FIVE VOLUMES

Containing over 5500 software product descriptions, the ICP Software Directory has been published by Internatioal Computer Programs, Inc. for the past 12 years,

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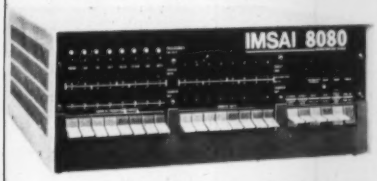

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CIRCLE 137 ON READER SERVICE CARD

BUSINESS AND PERSONAL
APPLICATIONS FOR YOUR TRS-80

MAIL-LIST Store up to 1300 names and addresses per 5¼" diskette, sort them alphabetically or by zip, select them by special code or print all, complete with special updating routines. Requires 16K, two disk drives, and line printer. On diskette. **$49.95**

FILE-IT The data-base system for the TRS-80! Files limited only by disk and memory space! Less than one second access to any record, any subrecord! Complete documentation allows custom modification to your specific needs. On diskette. **$24.95**

ED-IT Disk-operating word-oriented editing system enables you to modify any ASCII files...even Basic and Pilot programs! Find and change lines, fix spellings, change variables! On diskette. **$24.95**

C-10s only $1.00; Diskettes $3.50 (Min. 10 each)

Other programs available, too. Free List.

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Or Call (415) 573-8217

CIRCLE 163 ON READER SERVICE CARD

making it the oldest and largest single source of software product information today.

ICP has now expanded the Software Directory to a new total of five volumes, each published twice a year.

The split, from the present three volumes to five volumes dealing with software products and services, will make it even easier for software buyers to locate information on specific products. Additionally, users of the Directory will now find it simplier to identify which volumes are pertinent for their particular needs.

All volumes are available on a yearly subscription basis; purchase entitles the subscriber to the most recent published volume of his choice plus the next updated version of that volume. The annual subscription is $65.00 per volume with a 20 % discount on subscriptions for more than one volume. The contents of each volume are as follows:

Date Processing Management will contain information on systems software currently available and will be published twice a year in January and July.

Business Management: Cross Industry Applications will carry software product information having general applicability to many different business disciplines, ie., payroll, general ledger, etc. The volume will be published in February and August.

Business Management: Industry Specific Applications lists products and services designed and supported for a specific industry. It will be published in March and September.

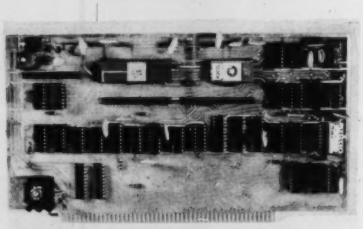
Mini-Small Business Systems: Cross Industry will contain listings of both systems software and general applications software for mini computers and will be published in April and October.

Mini-Small Business Systems: Industry Specific provides product and service information designed for mini computers used by specific industries. May and November are publication months for this volume.

International Computer Programs, Inc., 9000 Keystone Crossing, Indianapolis, In 46240. (317) 844-7461.

CIRCLE 237 ON READER SERVICE CARD

HARDWARE



COMBINATION FLOPPY DISK AND S100 ADAPTOR FOR PET!

The EXS100 from CGRS Microtech provides a combination Floppy Disk Controller and S100 Adaptor for the PET computer. The EXS100 is a single S100 PC board that connects to the PET memory expansion socket with a flat cable. The board can then be plugged into any S100 mainframe for expansion to the popular S100 bus. Up to 3 Minifloppy Disk Drives plug directly into the EXS100 giving the PET computer high speed disk storage.

As a Flopy Disk Controller, the EXS100 uses the standard IBM 3740 format and will drive up to 3 minifloppy disk drives for up to 240 kilobytes of storage. A special software package is available that allows the PET user to load and store programs from the disk. The EXS100 board also has provision for EPROM storage on-board, so that the disk software will always be instantly available.

The EXS100 is available in three versions: 1-EXS100 assembled as an S100 Adaptor only, $199.95; 2-EXS100 assembled as a disk controller only, $299.95; 3-EXS100 assembled as a combination S100 adaptor and disk controller, $349.95. The board is also available in a complete Disk Package, $799.95.

CGRS Microtech, P.O. Box 368, Southampton, PA, 18966.

CIRCLE 238 ON READER SERVICE CARD

RAM BOARDS IN 16K, 32K, 48K, and 64K BYTES

Processor Technology has introduced a family of four dynamic RAM boards with capacities of 16K, 32K, 48K, and 64K bytes — collectively designated the nKRA RAM boards.

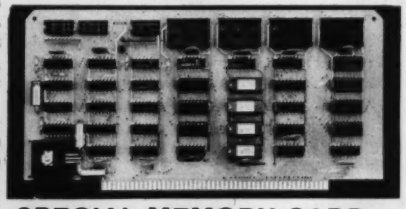
Refresh is synchronous, so no wait states can slow the microprocessor. Switch-selectable addressing eliminates jumper wires and the need to power down when readdressing blocks of memory.

Board design permits future incorporation of bank select option. With bank select memory may be expanded far beyond 64 bytes with all memory on-line continously. Large programs — such as FORTRAN or PL/M compilers — can be loaded.

Worst case access time is 400 nsec. Cycle time is 520 nsec. Power requirements are +8 to +40 VDC at 1 mA maximum, +15 to +19 VDC at 150 maximum and -15 to -19 VDC at 50 mA maximum. No power supplies need be regulated.

Prices range from $429 to $1350. Boards are available through Processor Technology dealers. For the location of newest dealer, dial toll-free Processor Technology's dealer locator hotline 800-227-1241 (In California dial 800-972-5951). For new product literature address Processor Technology Corporation, 7100 Johnson Drive, Pleasanton, California 94566.

CIRCLE 239 ON READER SERVICE CARD



SPECIAL MEMORY CARD ADDS DEVELOPMENT CAPABILITY TO EXISTING MICROCOMPUTERS

Pragmatic Designs has introduced DBM-1, a memory card that allows any S-100 type computer to be used as a memory emulator during program development for small, dedicated systems.

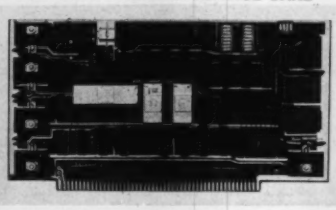
The DBM-1 is a 2K byte memory card which can be accessed by both a development computer and an application computer. The development computer loads the memory with the applications program. This program can then be executed by the target computer. During debugging, the applications computer can be halted and the program changed using the development computer's monitor commands. This effectively extends the more powerful development computer "into" the application computer's memory, eliminating the need for time consuming EPROM programming during program development. Once the program is debugged it can be programmed into an EPROM and installed in the application computer. The DBM-1 can be used as normal system memory when it is not being used for development.

Two DBM-1's can be cascaded for applications requiring up to 4K of program memory. In these applications the breakpoint logic is daisy chained, allowing the breakpoint to be set for any address in the 4K block.

DBM-1 plugs into the popular S-100 bus. The memories have an access time of 300 NS, allowing full speed memory emulation with virtually all popular microcomputers.

Pragmatic Designs, Inc. 711 Stierlin Road, Mountain View, CA 94043.

CIRCLE 240 ON READER SERVICE CARD



S-100 8080 CPU BOARD

SSM (formerly Solid State Music)

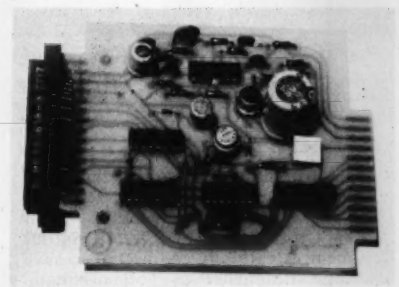
introduces its new CBI 8080 CPU board for S-100 bus computers. The CBI contains enough RAM, EPROM and other features to allow a 2 board computer. All that is needed is an I/O or video board.

The CBI has 256 bytes of on-board RAM for scratch memory that can be DIP switch addressed to any 256 byte boundary. Sockets are provided for 2K of 2708 EPROMs for a monitor program, small operating system, industrial control software on other functions. The EPROMs are DIP switch addressable to any 2K boundary. For operation without a front panel, the CBI can vector jump to the beginning address of the on-board EPROM on power-up or reset.

An 8 bit parallel input port with separate status is provided on the CBI, with DIP switch addressing up to 31 decimal. The input port can be used for a keyboard or for up to 8 sensing lines for home or industrial control application.

Available in kit or assembled form, $144.95. SSM, 2116 Walsh Avenue, Santa Clara CA 95050.

CIRCLE 241 ON READER SERVICE CARD



D-TO-A FOR PET

Technical Hardware, Inc. has announced an eight bit analog interface card that plugs directly into the PET computer. This card can be used as a digital-to-analog converter to generate music with precisely controlled harmonic structure. It also functions as an A-D converter. This makes it possible to interface ADAK-1-PET with any combination of up to eight joysticks, thermometers, light sensors, etc. The software cassette supplied with ADAK-1-PET includes programs for waveform generation by means of Fourier synthesis, two voice songs utilizing synthetic waveforms over an 8 octave range, and several paddle games. Extensive machine language coding is used to provide fast response. General purpose machine language handling software also is included on the cassette, The ADAK-1-PET is priced at $99.50. A general purpose version that can be used with any 8 bit microprocessor is $69.50 Technical Hardware Inc., Box 3609, Fullerton, CA 92631.

CIRCLE 242 ON READER SERVICE CARD

SOUND SYNTHESIZER FOR THE TRS-80

Proteus Computing has developed a sound synthesizing system for the TRS-80 microcomputer. The unit can produce over 250 various tones covering 8 octaves. Because of the wide range and speed by which notes can be produced, any song or game sound can easily be created. Unlike most other sound producing units on the market today, this unit is controlled totally from *simple* BASIC commands and *not* machine language. Aside from being easily programmed the unit is easy to install—just plug it into your Level II keyboard or interface, no extra hardware of any kind is needed.

The synthesizer is housed in an attractive veneer cabinet and comes complete with volume control, quality speaker, power source and ribbon cable connector.

Included with every unit is an instruction sheet and a demo program tape ready to CLOAD, with such items as STAR WARS theme (with lasars), The Entertainer, Flight of the Bumblebee, CLOSE ENCOUNTERS theme and others. If you have some other microsystem, modifications are possible. Write for conversion tips. $150, tested & assembled. Proteus Computing, P.O. Box 2252. Livonia Michigan, 48150.

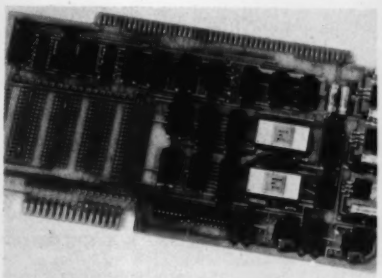
CIRCLE 243 ON READER SERVICE CARD

M9900 CPU—16 BIT MINI FOR S-100 BUS WITH PASCAL

The M9900 CPU interfaces the Texas Instruments TMS9900 to the S-100 bus. The single-board processor offers the power of a 16-bit minicomputer with hardware multiply and divide, multiple sets of 16 general registers, and multiple addressing modes, while retaining compatibility with most S-100 memories and peripherals. The M9900 allows optional use of 16 bit memories, which achieve the highest S-100 memory performance available today.

Software includes a complete disc operating system featuring a Sequential Pascal compiler. A powerful text editor, BASIC, relocatable assembler, linking loader, interactive debugger, and diagnostics are included with the system. $700 assembled, $550 kit.

Marinchip Systems, 16 St. Jude Road, Mill Valley CA 94941.



12-BIT DIGITAL-TO-ANALOG CONVERSION BOARD

A new Precision Analog Interface Board, featuring two 12-bit digital-to-analog converters, has become the latest product entry from Vector Graphic, Inc., designers and manufacturers of small business microsystems.

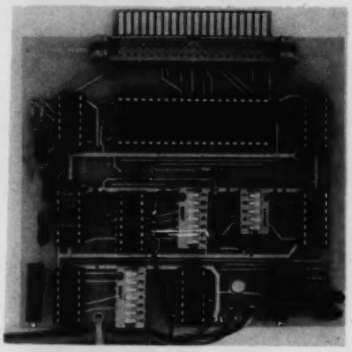
Fully assembled, the PAIB supports a myriad of measurement and control applications and is compatible with most S-100 bus microprocessors.

Two analog output channels and a variety of output voltage ranges allow operation in either monopolar or bipolar modes. In addition, a convenient patch area allows user-designed circuitry to be added.

When used with a microcomputer, Vector Graphic's PAIB functions as a successive-approximation analog-to-digital converter for measurement and control of up to eight analog input channels. A separate 8-bit digital output port is also featured on the board. $390.

Vector Graphic Inc., 31364 Via Colinas, Westlake Village CA 91361.

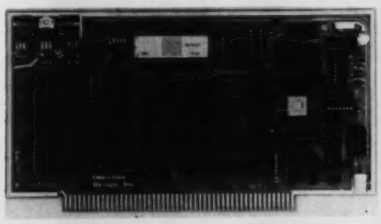
CIRCLE 244 ON READER SERVICE CARD



TRS-80 SERIAL I/O

This board is RS-232 Compatible and can be used with or without the expansion bus. There are on board switch selectable baud rates of 110, 150, 300, 600, 1200, and 2400, also parity odd or even or no parity, 5 to 8 data bits, and 1 or 2 stop bits. And has a D.T.R. line. Board only $19.95, part no. 8010, with parts $59.95 part no. 8010A, assembled $79.95 part no. 8010C. Electronic Systems P.O. Box 21638 San Jose, CA 95151 (408) 226-4064.

CIRCLE 245 ON READER SERVICE CARD



ABSOLUTE VIDEO CONTROL

A new S-100 compatible Video Display Interface (VDI) provides unequaled software control of screen presentation. The video board from Objective Design, Inc. will create alphanumeric displays of 80 x 24, 64 x 16, 64 x 32, 40 x 20, and many other formats—all selected by programming. Each individual character has reverse video and 4 levels of gray scale.

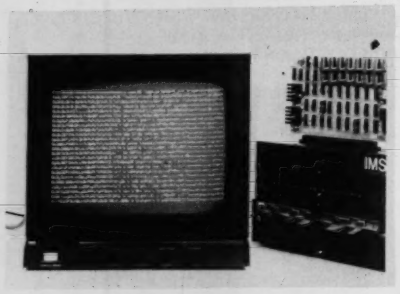
Users can select via software a synchronized access mode which prevents snow and other screen disturbances when entering data. The program-set display

parameters assure compatibility with any monitor — American or European standard, any number of scan lines, low or high resolution, interlace or non-interlace.

The character set is programmed in PROM, which can be replaced by the user. In addition, the VDI board is designed to combine with Objective Design's Programmable Character Generator card for an infinite variety of characters and super fine graphics. Maximum resolution is 512 x 512.

Objective Design, Inc., P.O. Box 20325, Tallahassee, FL 32304.

CIRCLE 246 ON READER SERVICE CARD



ALTR-2480 NEW GENERATION VIDEO DISPLAY BOARD WITH TRANSPARENT MEMORY

Matrox Electronic System, the company which introduced the video RAM alphanumeric CRT controller has developed another significant innovation in the design of alphanumeric display boards. The design concept has been incorporated into the ALTR-2480, a new 24 line x 80 character alphanumeric video interface card for the S100 bus.

This new concept, called Transparent Memory, solves the classic memory contention problem common to all CRT displays. The problem occurs because the display refresh memory must be accessible by both the CRT controller for CRT refresh and by the CPU.

The new Matrox transparent memory design eliminates this problem. The CPU can access the refresh memory at any time, the display is completely glitch free, and the CPU is never interrupted. The method is completely general and does not rely on the peculiar timing characteristics of a particular CPU.

So far, the transparent memory feature has been incorporated into three industry standard buses besides the S100 bus including the Intel/National SBC-80, DEC LSI-11/2 and Motorola Exorcisor.

All cards in the series feature memory mapped addressing. This allows the full power of the processor's instruction set to be used for display data manipulation. The 128 location character generator features the full ASCII set including upper and lower characters as well as limited graphics. A 5 x 7 dot matrix in a 6 x 10 dot cell is used resulting in a non-interlaced completely flicker free display. All models are available in both American and European TV standards and operate from a single + 5V power supply. A compatible family of graphics controller cards with variable resolutions ranging from 256 x 256 to 512 x 256 points is also available. $295.

Matrox Electronic Systems, 2795 Bates Rd., Montreal, Que., Canada H3S 1BS.

CIRCLE 247 ON READER SERVICE CARD

ADD HIGH QUALITY PRINTING TO YOUR MICRO

If you already own a Selectric® typewriter, you already have a high quality printer for use with your microprocessor. ESCON interface system lets you convert a standard IBM office Selectric® into an output printer for your microprocessor in just a few hours. No holes to drill. Selectric® typewriters onto which ESCON systems are installed in accordance with factory instructions remain eligible for IBM warranty and service. Complete instructions provided. Entire installation takes only a few hours.

SPECIFICATIONS.

Compatible with any systems using the S-100 bus—e.g. ALTAIR, IMSAI, SOL, Poly 88, Equinox, etc.
Output: Parallel
Code: ASCII
—User Software Controlled: User defines polarity and position of status bit indicating comple tion of operation.
Input: One LS-TTL
Output Current: 24mA
Bus: S-100
Power Supply: 30VDC at 2A

DESCRIPTION	ASSEMBLED
Mechanical parts, solenoids and instruction manual	EAA $250.00
Power supply and solenoid DRIVERS	EA-B $140.00*
COMPUTER INTERFACE CARD Complete set	EAC EA-T $496.00
Instruction manual (if purchased separately)	$ 9.95

***available in kit form, subtract $20.00.**

CIRCLE 248 ON READER SERVICE CARD

MISCELLANEOUS

NEW PRINTOUT DESIGNER

A unique 70 line x 160 column printout design sheet from Stirling/Bekdorf™ helps mini- and microcomputer users plan and code report formats more easily. The 160-column width allows extra space for reports printed on machines using condensed-mode type.

Rather than use grid cells the actual size of the final printed characters, the Stirling/Bekdorf 78P4 uses scaled-up cells for human writing comfort. Each 78P4 cell is 3mm wide by 5mm high, giving nearly twice the character-writing area of some other printout form cells.

Special coded column markings at columns 80, 96, and 132 let a programmer easily track the relative position of each printed character. Scaled page length arrows reference the last possible printed line on standard 8½" and 11" paper (for printers yielding 6 printed lines per vertical inch).

Far more stout than other printout design sheets, each 78P4 can stand vigorous erasures and substantial handling.

78P4 Printout Design Sheets are the newest member of the Stirling/Bekdorf system for rapid, accurate software development. Every part of the system, the 78F2 Flowchartrix™, 78C1 Combination Coding/CRT Layout, and 78P4 Printout Designers, is carefully engineered to save time and headaches as you originate, modify, or extend small-computer instruction sets.

Stirling/Bekdorf, 4407 Parkwood, San Antonio TX 78218.

CIRCLE 249 ON READER SERVICE CARD

BORIS ... THE WORLD'S SMALLEST TALKING CHESS COMPUTER

Chafitz, Inc. has introduced two new battery-operated models of BORIS, the talking chess computer. Both models are designed to teach chess by suggesting moves for beginners and play at varying skill levels. Experienced players can use BORIS' exclusive position programming feature to set up special board positions for practicing strategies or to remove pieces for handicapping. During each game, BORIS

flashes messages to his opponents from his seemingly-human brain. Both models know all classic chess rules and solve any mate-in-two problem.

BORIS MASTER, housed in a solid walnut case, operates for 8 hours on rechargeable batteries. His special Position Storage Memory holds board positions for up to one week, allowing games to be interrupted and resumed during that time. BORIS JR. operates for over 10 hours using AA batteries. Currently, BORIS is regarded as the most advanced personal chess computer available. $99.95. Chafitz, 1055 First Street, Rockville MD 20850.

CIRCLE 250 ON READER SERVICE CARD

SUPERPHONE—IT'S THE MOST TALENTED TELEPHONE IN TOWN

It's a standard size pushbutton phone that easily connects to any phone line—rotary dial or touchtone.

It's a 4-function calculator that can be used at any time—even when you're talking. Calculations appear on the bright LED display.

It stores up to 20 phone numbers, including area and access codes, and dials them automatically. It redials the last number automatically if you get a busy signal. You just press the "re-dial" button. The phone numbers can be easily changed at any time.

It's a 24-hour digital alarm clock that can be set to the minute to remind you of appointments. It has a built-in stop watch to time your calls. Its calendar clock mode displays the hour, minute, day and date. It comes in 5 colors. It has a built-in battery that continues the phone functions in the event of a power failure. $229.95.

I.C.P. Marketing, 3031 Tisch Way, Suite 750, San Jose, CA 95128.

CIRCLE 251 ON READER SERVICE CARD

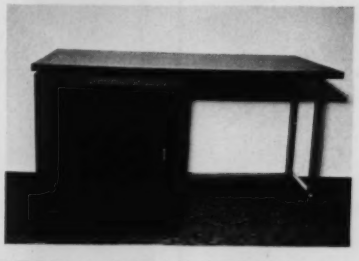
CUSTOM CARRYING CASE FOR TRS-80 COMPUTER

A matched set of custom-built cases to carry, protect and store the Radio Shack TRS-80 TM computer is now available from Ambico Inc. These handsomely crafted cases, designed and manufactured in the United States, make transporting and storage of the TRS-80 components safe and convenient.

Each carrying case is made of durable vinyl and has a handsome black textured finish and a luggage style handle. The cases are dustproof and have bottom skids for added protection. The larger case "A" holds the computer's 12-in. video monitor, while case "B" is designed to accommodate the computer keyboard, cassette machine, power supply, cables, cassettes and accessories. $35, case "A"; $25, case "B."

Ambico Inc., 101 Horton Avenue, Lynbrook, NY 11563.

CIRCLE 252 ON READER SERVICE CARD



DESK & CPU CABINET

"The Ideal Work Station." Now you can combine the superior performance of your own computersystem with the beauty and convenience of our new work station. $290.

- 24″x48″ or 32″x60″ black laminant desk top.
- 26″ chrome legs with cross brace and adjustable levelers, attaches to CPU Cabinet.

Radio Shack Computer Users

TRS-80 monthly newsletter

The largest publication devoted to the TRS-80 System

- Business
- Personal Finance
- Practical Applications
- Gambling—Games
- Latest RADIO SHACK Developments
- Software Exchange
- Market Place
- Questions and Answers
- Program Printouts
- . . . and more

Major programs published monthly . . . Complete income tax program (long and short forms) . . . Inventory control . . . Extensive mailing list and file program . . . Payroll . . . Stock selection and indicators . . . Horse selector for picking winners . . . Renumber program lines . . . Chess . . . Checkers . . . Financial package . . .

$24. Per Year

MATHEMATICAL APPLICATIONS SERVICE

Box 149C New City, New York 10956 (914) 425-1535

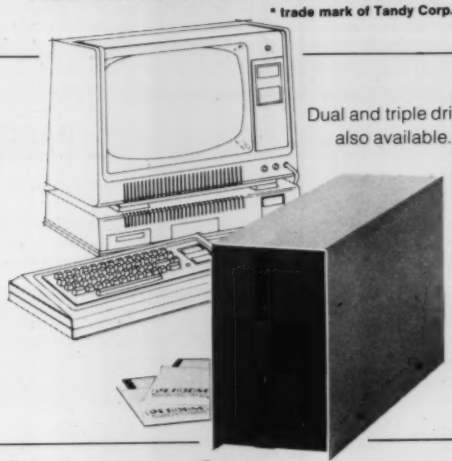
Send for FREE Software Catalogue (including listings of hundreds of TRS programs available on cassette and diskette).

CIRCLE 151 ON READER SERVICE CARD

NOW. . .

Add-on Mini-Disc for the TRS-80*

* trade mark of Tandy Corp.



Dual and triple drives also available.

only **$399.00**

Requires 16K RAM, Level II BASIC and Expansion Interface.

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PERCOM DATA COMPANY, INC.
DEPT. C • 318 BARNES • GARLAND, TEXAS 75042
Phone: (214) 272-3421 or
Call toll free: 1-800-527-1592

CIRCLE 155 ON READER SERVICE CARD

- Simulated walnut grain finish with black laminant toe-kick.
- Bronze (clear) Plexiglass door with chrome hardware and magnetic lock.
- Removable Back Panel.
- RETMA STD 19″ rack—21″ high front and rear metal mounting rails (4).
- Adjustable shelves are optional.
- Dimensions: 23″w x 26″h x 23½″d
  23″w x 26″h x 32″d

GROUP TWO, 4901 Morena Blvd., Suite #305, San Diego, CA 92117.

CIRCLE 253 ON READER SERVICE CARD

THE ENERGY MONITOR

The Energy Monitor, an electronic device that visually converts kilowatt hours used into actual dollars and cents, has been developed by *Dupont Energy Management Corp.* Designed to save consumers money, the Energy Monitor has a built-in micro-computer that automatically computes energy use on a daily as well as monthly basis. Set a budget and if usage exceeds the desired budgeted amount, a warning flashes. Easily installed and matches any decor. $295. Dupont Energy Management Corp., 3301 Conflans, Suite 102, Irving, TX 75061.

CIRCLE 254 ON READER SERVICE CARD

TIME CONTROLLER

ChronTrol, a unique micro-computer time controller with the capability to perform a wide range of time control variations, has been developed and introduced by Lindburg Enterprises of San Diego, California.

ChronTrol's uses range from security and household appliance control to the intricate time variations needed in laboratory or experimental work.

ChronTrol was originally conceived for its uses in horticulture and indoor gardening, where it can promote the growth of plants by simulating the natural daily variations of the photoperiod.

Using ChronTrol is simple and requires no special skills. You simply plug ChronTrol into a standard 120 volt outlet, set the program you desire on the 20-key control panel, and plug the device to be controlled into the outlet on ChronTrol's rear panel.

ChronTrol can operate up to 10 on/off functions—the duration of the "on" time can be as brief as one second or as long as 168 hours.

The basic ChronTrol unit has one outlet but, multiple outlet models are available, with two or four outlets, that allow performance of multiple operations, separately or coordinately. A battery-powered memory protection system is also available as an option, and protects all programs in case of power interruption. $70.

Lindburg Enterprises, 4888 Ronson Court, San Diego, CA 92111, or by calling (714) 292-9292.

CIRCLE 255 ON READER SERVICE CARD

COMPUTERS

PASCAL MICROENGINE COMPUTER SYSTEM

Computer interface Technology (CIT), a major distributor and manufacturer of computers and computer peripherals, announced that they are marketing the world's first 16-bit PASCAL computer system that directly executes PASCAL object problems.

The system identified as the CIT- PME-16 PASCAL MICROENGINE, uses the Western Digital P-Machine LSI chip set and supports the University of California, San Diego (UCSD) version of PASCAL.

CIT's PASCAL MICROENGINE SYSTEM comes complete with desktop CPU, 64K of RAM memory, dual 8-inch floppy disk subsystem, 60cps line printer, CRT with upper and lower case letters, and the PASCAL Operating System on diskette. Also included are complete documentation and technical manuals. The UCSD software package includes the BASIC and PASCAL compiler, file manager, editor and debugging aid.

In addition to the complete system, CIT will market the PASCAL MICRO-ENGINE as a complete computer without peripherals.

Suggested quantity one retail price for the computer is $2995 and $8000 for the complete system.

Computer Interface Technology, 2080 South Grand, Grand Centre, Santa Ana CA 92705.

CIRCLE 256 ON READER SERVICE CARD

ATARI INC. ENTERS PERSONAL-HOME COMPUTER INDUSTRY

Atari Inc., a division of Warner Communications Inc. and the nation's leading manufacturer of sophisticated computer-controlled video games, is entering the personal-home computer industry.

Atari will shortly introduce two new personal computer systems that have been developed for use by both those people with no prior computer experience and those with experience and sophisticated needs and requirements.

The Atari line of personal computers will have a substantial library of computer software consisting of applications such as: Personal Financial Management; Income Tax Preparation; Household and Office Record Keeping; Computer Aided Instruction in over 20 subject areas, including Math, English, History, Literature, Economics, Psychology, Auto Mechanics and many others.

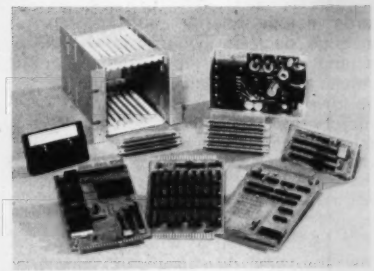
Both the ATARI-400™ System and the ATARI-800™ System are programmable by the user in the most popular language for personal computers, BASIC. Other programming languages will become available on preprogrammed solid state cartridges.

The general purpose ATARI-400™ System allows an easy transition from video games to a full-fledged personal computer. The System features a 57 key monopanel keyboard, single cartridge slot for solid state programs of up to 8,000 bytes of memory, cassette recorder capability and an internal audio speaker.

The specialized ATARI-800™ System features dual cartridge capability, user expandable random access memory up to

48,000 bytes, a series of optional peripheral devices including a high speed floppy disc for mass data storage and retrieval, and a 40-column printer utilizing standard paper. The versatile and expandable nature of the ATARI-800™ System allows the consumer to select components tailored to their specialized needs. Other peripheral devices, including telecommunications capabilities are currently under development. Atari, Inc., 75 Rockefeller Plaza, New York NY 10019.

CIRCLE 257 ON READER SERVICE CARD



6800 DEVELOPMENT PACKAGE $895

A 16K development system for the 6800 can be configured for $895 according to a special price formula announced by WINTEK Corp. The development package includes a burned in single board computer, 16K bytes RAM, RS-232 interface with switch selectable baud rates, 300 and 2400 baud cassette interfaces, FANTOM-II monitor/debug ROM, powerful editor/assembler software, card rack, back plane, and power supply. The package price is $177 less than the regular $1079 price. An EROM programmer module and 15 interface modules are also available on 4½" x 6½" boards with industry standard 22/44 pin edge connectors. WINTEK Corp., 902 N. 9th St., Lafayette IN 47904.

CIRCLE 258 ON READER SERVICE CARD

SINGLE BOARD MICROCOMPUTER WITH FLOPPY DISK CONTROLLER

The 90F/MPS microcomputer is a single board OEM product, based on the Z80™ microprocessor family.

90F/MPS board-resident facilities include: multi-density DMA floppy disk controller, up to 65 Kbytes dynamic RAM, up to 14 Kbytes of ultraviolet erasable PROM with programmer, 1 Kbyte of static RAM, up to four 8-bit programmable I/O ports (two Z80-PIO's), four programmable counter/timer channels (Z80-CTC), an RS232C or 20 milliampere serial port with selectable baud rates, 2.5 or 4MHz. operation and, PROM-resident system monitor with debug capabilities.

Features of the 90F/MPS' floppy disk controller include: DMA-based disk access, support of up to four 5¼" or 8" single/double density drives, multi-track transfers and data scanning.

Single unit pricing for the 90F/MPS microcomputer with 16KB dynamic RAM and two parallel ports is $1,295.

CIRCLE 259 ON READER SERVICE CARD

DIGITAL EQUIPMENT'S DATASYSTEM 325

New cabinet and furniture design of Digital Equipment's Datasystem 325 small business computer features brightly colored silkscreen prints created by graphic artist Corita Kent. D325 configuration shown includes new VT100 video display terminal, central processor with 60K bytes of memory, cartridge-type disk units with 10 million characters of storage, and 180-character-per-second printer. Digital Equipment Corporation, Maynard MA 01754.

CIRCLE 260 ON READER SERVICE CARD

4044 — $5

450 nsec. — Quantity 64

	250 nsec.	450 nsec.
1-31 chips	$8	$7
32-63 chips	7	6
64-over	6	5

2716 — $49

Single 5V Supply — Limited Quantity

Z-80A — $19

4 Mhz. Version

Other Specials

6810 — $4.25 **8251A — $7.50**

All are Factory Prime Chips — Guaranteed Good

Seattle Computer Products, Inc.
1114 Industry Drive, Seattle, WA. 98188
(206) 575-1830

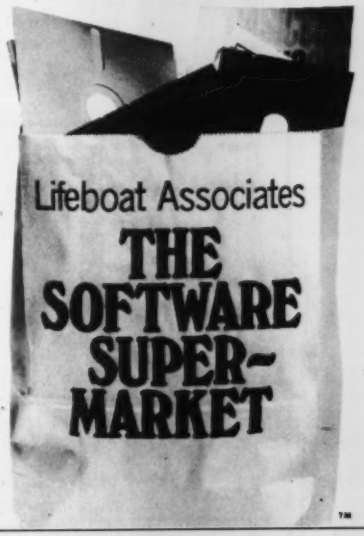
CIRCLE 131 ON READER SERVICE CARD

It's in the bag.

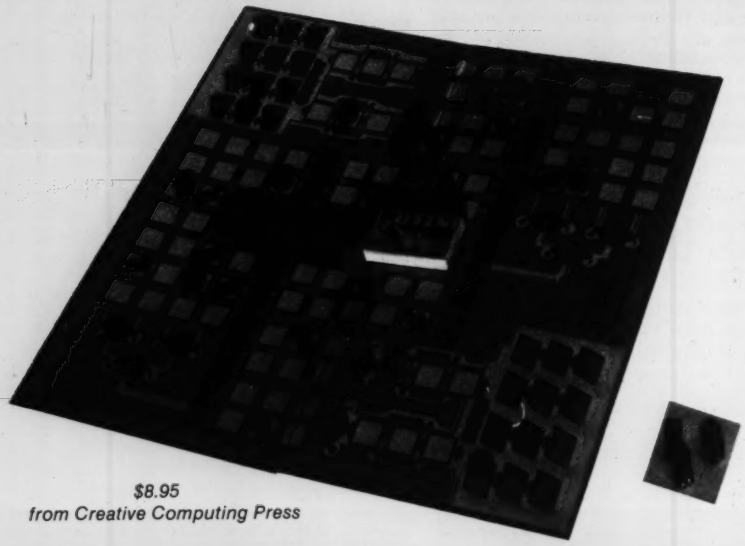
What is?

The biggest and best selection of microcomputer software anywhere. And the list grows bigger every day. CP/M configured for the most popular 8080/Z-80 microcomputer systems and other terrific software, now available. Call or write for our latest literature.

Lifeboat Associates, Suite 506, 164 West 83rd Street
New York, N.Y. 10024/(212) 580-0082



creative computing



$8.95
from Creative Computing Press

Computer Rage

This fun and educational new board game is based on a large-scale multiprocessing computer system. The object is to move your three programs from input to output. Moves are determined by the roll of three binary dice representing bits in a computer. Hazards include priority interrupts, program bugs, decision symbols, power failures and restricted input and output channels. Notes are included for adapting game for school instruction. A perfect introductory tool to binary math and the seemingly-complex computer. [6Z]

Binary Dice

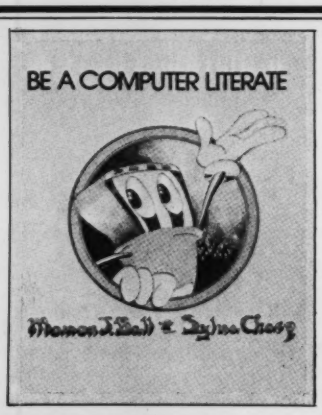
Now, the same dice used in Computer Rage can be purchased separately. Three binary dice (red, green and blue) in a zip-lock bag. $1.25 postpaid [3G].

COMPUTER SCIENCE
BOOKS
"...No thanks, ... just scanning..."
"But you distinctly said to dump the files."
.14
.7
.03
"When are you going to learn the difference between a fly and a floating decimal?"

The Colossal Computer Cartoon Book

Take a break. Sit back and
and relax with the biggest and best collection
of computer cartoons ever, hundreds and
hundreds of cartoons about computers, robots, calculators AI and much more. [6G]

$4.95
120 pp. softbound
from Creative Computing Press



$3.95
61 pp. softbound
from Creative Computing Press

Be A Computer Literate

by Marion J. Ball and Sylvia Charp

This is the most basic, introductory book on computers ever put together for instructional use. Its full-color diagrams, drawings, photos and large, explicit type make this book a pleasure to read. This chapter titles, themselves, best illustrate its contents— [6H]

I Introduction
II What Are Computers
III Kinds of Computers
IV What Goes On Inside Computers
V Communicating With The Computer
VI Language Of The Computer
VII How To Write A Simple Program
VIII How Computers Work For Us
Glossary

brings you its best

Volume 1

$8.95
328 pp. softbound
from Creative Computing Press

The Best of Creative Computing

The first two years of *Creative Computing* magazine have been edited into two big blockbuster books. *American Vocational Journal* said of Volume 1, "This book is the 'Whole Earth Catalog' of computers." [6A] Volume 2 continues in the same tradition. "Non-technical in approach, its pages are filled with information, articles, games and activities. Fun layout."—*American Libraries.* [6B]

Volume 2

$8.95
336 pp. softbound
from Creative Computing Press

4-Year Cumulative Index

Yes, folks, *Creative Computing* has been around for four (count them, 4) years! Our first issue was Nov/Dec 1974 and Vol. 4, No. 6 was Nov/Dec 1978. For those of you with all those issues around it's sometimes difficult to remember just when that neat article on Magic Squares appeared, or which four issues carried the CAI Series of articles, or in which issues we reviewed all 34 books on BASIC.

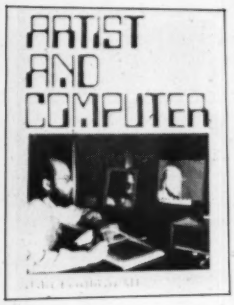
Also, not to overlook our cousin ROM, we've included all the meaty articles, programs, reviews and other information from that periodical too.

We've cross-referenced articles that have appeared in both *Creative Computing* magazine and the *Best of Creative Computing Vols. 1 and 2,* hence, the current source of every article is listed.

Articles are classified by subject area and listed by title and author. Over 2000 separate items are included. The index does not include a cross-reference to author.

The index was put together by Jane Fletcher on a DECsystem-10 using the text editor and runoff (with a Diablo 1620).

Price for this blockbuster of an index is just $1.00 postpaid, $1.25 for first class delivery, $2.00 foreign. Orders must include payment (no bank cards, COD's, or orders to be billed).



Artist and Computer

by Ruth Leavitt

"Get yourself a copy of this book if you enjoy feeding your mind a diet of tantalizing high-impact information."
San Francisco Review of Books.

$4.95
121 pp. softbound
from Creative Computing Press

This unique art book covers a multitude of computer uses and the very latest techniques in computer-generated art. In its pages, 35 artists explain how the computer can be programmed either to actualize the artist's concept (such as the visualization of fabric before it is woven) or to produce finished pieces. Over 160 examples, some in full color. [6D]

The Best of BYTE

$11.95
386 pp. softbound
from Creative Computing Press

This is a blockbuster of a book containing the majority of material from the first 12 issues of *Byte* magazine. The 146 pages devoted to hardware are crammed full of how-to articles on everything from TV displays to joysticks to cassette interfaces and computer kits. But hardware without software might as well be a boat anchor, so there are 125 pages of software and applications ranging from on-line debuggers to games to a complete small business accounting system. A section on theory examines the how and why behind the circuits and programs, and "opinion" looks at where this explosive new hobby is heading. [6F]

HEATH ANNOUNCES ASSEMBLED COMPUTERS

From Heath Company, Benton Harbor, Michigan comes word that most major Heath Computer products are now available in assembled as well as kit form.

Computer products available in assembled form include the WH8 8-Bit Computer and its associated memory and interface boards, the WH17 Floppy Disk System for the WH8, the WH11A 16-Bit Computer and associated memory and interface boards, the WH27 Floppy Disk System for the WH11A, and the WH14 Line Printer designed for use with either computer system.

For more information about the entire line of assembled computer products from Heath, send for a FREE copy of the latest Heathkit catalog. Write Heath Company, Department 350-830, Benton Harbor, Michigan 49022.

CIRCLE 261 ON READER SERVICE CARD

"THE SYSTEM"FROM MICRODASYS

At $549 (kit), the MicroDaSys SYSTEM 1 is truly one of the best buys on the market. The system features our custom console, keyboard, S-100 bus motherboard, 16 amp power supply, fan, 64 x 16 upper and lower case video/graphics card, and the MD-690A CPU board. The assembled price is $699.

Besides combining the 6800 processor (6802) with the S-100 bus, the MD-609A is truly a system on a board. Features include a 2400 baud cassette interface, 10K PROM space, 1K RAM, 20 I/0 bits, an RS-232 interface, and interrupt driven keyboard input. This CPU is as flexible as state-of-art should be, permitting the user such options as putting 8K BASIC in on-card PROM, multitasking and timesharing. There is even 2400 Hz real-time clock circuitry provided.

The 1K PROM monitor (MONBUG) at the heart of THE SYSTEM is compatible with the standard 6800 ROM (MIKBUG) As a result, virtually all 6800 software will run on THE SYSTEM. But MONBUG outputs to memory-mapped video cards permitting graphics, animation and our exclusive memory window. MONBUG is only available on MicroDaSys systems.

The MD-609A is upwards compatible with the third generation Motorola 6809 processor chip. The 6809 offers 16 bit internal arithmetic, hardware multiplication, 18 addressing modes and 3 times the throughput of a 4 MHz Z-80. MicroDaSys will soon offer a PASCAL compiler, COBAL and FORTRAN for use with the new 6809.

The SYSTEM 2 adds a 32K RAM card populated with 8K of RAM and is priced at just $699 (kit), $899 (assembled). Adding memory to the SYSTEM 2 is as easy as plugging memory chips on the 32K STATIC RAM card. Each 8K additional RAM is $219.

Our SYSTEM 3 combines a full 32K STATIC RAM with a mini-floppy disk drive, controller and our DOS for exceptional computational capability. $1499 (kit), or $1799 (assembled).

MicroDaSys, P.O. Box 36051, Los Angeles, CA 90036.

CIRCLE 262 ON READER SERVICE CARD

ESCROW BUSINESS ADMINISTRATION (EBA) SYSTEMS

AIC announced today the release of a new Escrow Business Administration (EBA) System designed to significantly reduce the administrative costs and problems which exist in many California escrow and real estate offices.

This new system will greatly speed up the processing of escrow transaction, simplify the closing process, and provide better overall control of an escrow office's dollars and documents. The same system can also eliminate the need for separate and costly word processing machines.

Designed specifically to overcome the limitations and drawbacks of the computerized escrow processing services previously provided by some commercial banks, the EBA provides much faster closing times and with a greatly reduced error rate.

The EBA System consists of a microcomputer mounted in an attractive desk, a television-like video display terminal, a high-speed printer, and a package of computer programs which took ten months to develop. The memory of this system is provided by economical "floppy diskettes", each of which can hold hundreds of checks, receipts, and other records. The video terminal allows viewing and correction of escrow information at speeds up to 960 characters per second (cps). One of the two standard printers provides typewriter-quality reports and letter-perfect documents at 55 cps. A 120 cps matrix printer is also available.

The EBA recently completed months of field testing in a major Los Angeles escrow office and is now in production use. Multiple input terminals have been added at that location to accommodate several operators at one time.

The EBA can be either purchased or leased. The lease costs of the four EBA models range as low as $2.36 to $2.87 per hour on a 40 hour work week basis.

Adventures In Computing, Inc., 8756 Warner Avenue, Fountain Valley, CA 92708.

CIRCLE 263 ON READER SERVICE CARD

PERIPHERALS

THE WRITEHANDER™— NEW ONE HAND TYPING KEYBOARDS—MODELS FOR EITHER HAND

A one handed keyboard for computers, terminals, displays and other 128 character ASCII or ISO coded devices is now available in both right and left hand configurations and in large and small sizes.

The new model features snap-action switches, improved circuitry, and Keypressed signals as well as Strobe pulses to signal that data are available.

The small keyboard is finding wide application for touch typing and data entry where a free hand is needed, such as for telephone orders, computer programming, and for astronomy and microscope observations. Pencil notes may be written with one hand while typing data with the other.

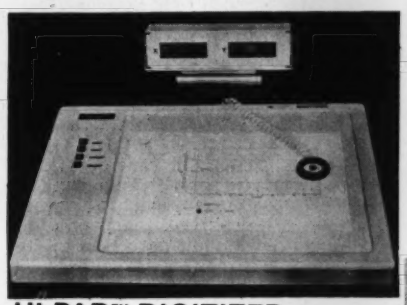
The keyboard code is easily learned by blind people and those with a disabled hand. When connected to portable equipment, the Writehander allows inventory or field survey data to be conveniently entered with one hand.

The Writehander can be interfaced with any computer, terminal, printer or other device that will accept parallel 7-bit code signals and provide the nominal power required.

The Writehander can transmit the various European alphabets in ISO registered codes by using slightly different finger codes for a few characters. Katakana and Cyrillic code charts are also available.

NewO company, 246 Walter Hays Drive, Palo Alto CA 94303. NewO is in production on the new models.

CIRCLE 264 ON READER SERVICE CARD



HI PAD™ DIGITIZER

This 11 inch by 11 inch active surface digitizer offers user controllable features such as metric/inch capability, binary/BCD outputs, RS-232C/8-bit parallel interface, all selectable at the interface connector.

The HI PAD is accurate to ±.015 inches with a resolution of .005 inches. The data rate may be set to input up to 100 coordinate pairs per second. Four buttons on the edge of the tablet allow the user to relocate the origin and select point or stream modes of operation.

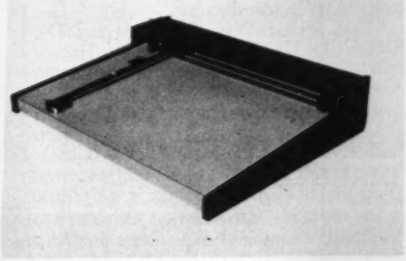
The unique cursor allows marking or non-marking of the curve being traced by merely depressing the cursor button at points being considered.

This new input device is a natural companion to the HI PLOT™ digital plotter recently announced by Houston Instrument.

An Optional Display is available. $795.00.

Houston Instrument, One Houston Square, Austin TX 78753.

CIRCLE 265 ON READER SERVICE CARD



PLOTTER UNIT

Sylvanhills Laboratory, Inc. has a new X-Y plotter unit which includes a plotter, drawing surface, electronics and power supply completely assembled and ready for interface to any eight-bit TTL Parallel port. Pen holder accepts any writing instrument or stylus 7-11 mm diameter; encoded for 0.01-in/pulse, but 0.005-in optional. Pen travel speed 2.5-in/sec max. with 24 volt supply. A basic 8080 software program is included in the Owners' Manual.

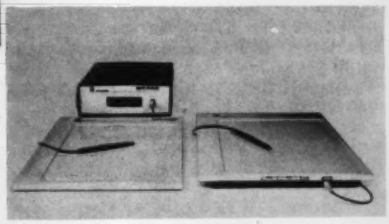
Applications include architectural, mechanical, and schematic drawing; PC board artwork, positioning of small objects; computer generated art; games; and many others.

The unit combines plotter, console, and power supply together at a low price: UNIT-1, 11″ x 17″ drawing area, $1,049; UNIT-2, 17″ x 22″ drawing area, $1,249.

Plotters are also available in kit form with console and power supply priced separately.

The plot driver software is now available as Ascii source files on paper tape, CP/M small disk formats. TEI and Cromemco small disk formats are also available. Both BASIC and assembler source are provided.

SYLVANHILLS LABORATORY, INC., P.O. Box 646, Pittsburg KS.



THE BIT PAD ONE

Summagraphics Corporation has added to its highly successful low-cost digitizer, the Bit Pad, with a new one-piece version, the BIT PAD ONE. BIT PAD ONE is a wholly integrated digitizer combining both the tablet and electronics in one table-top unit.

BIT PAD ONE is a full capability, high quality digitizer permitting ease of entry of positional information. The BIT PAD ONE is designed for fast, easy, low-cost data collection of X,Y values. The small size (11″ x 11″) and compact design make the BIT PAD ONE completely portable and adaptable to a wide variety of applications.

The Bit Pad is easily interfaced to a variety of micro computers via either 8-bit parallel output, RS232 Serial communications interface, and IEEE-488 standard interface. $666.

Summagraphics Corporation, 35 Brentwood Avenue, Fairfield CT 06430.

CIRCLE 266 ON READER SERVICE CARD

LOW COST LIGHT PEN FOR MICRO-PROCESSORS

Symtec Inc. has announced a new low cost light pen for micro computer use.

The new light pen is intended for the small business and home market and can be used for a wide range of applications. The new light pen can be used on any standard TV or display monitor in black and white or color. Uses include; menu selection, peripheral control, program branching, data input, graphics aid and much more.

The Symtec light pen is supplied complete with interface and provides an x,y coordinate number to the buss when the pen is activated by a touch sensitive switch or from software control. The Symtec light pen can provide x,y values of up to 255 in y and up to 511 in x and are software dividable to fit any screen size.

The new Symtec light pen was designed to complement the Apple II computer and installs directly into the Apple I/O plugs.

The Apple version of the Symtec light pen is provided with a demonstration cassette written in integer basic for easy modification by the user if desired and to allow easy use of the pen in the users own programs. A complete listing of the light pen routine and suggested uses is included in the applications manual.

The Symtec light pen for S-100 buss machines will be available in early 1979 and will provide comparable features.

$249.95. Computerland of Southfield, 29673 Northwestern Hwy., Southfield MI 48034.

CIRCLE 267 ON READER SERVICE CARD

PERK FOR PET PERSONAL COMPUTER

PERK is a plug-in, typewriter style, alphanumeric keyboard, designed to enhance the operation of the Commodore PET—a Personal Electronic Transactor with a great variety of applications.

Although supplied with a built-in calculator-type keyboard, the PET keyboard is only half the size of standard typewriter keys. The PET non-standard, block layout makes touch-typing virtually impossible.

The PERK standard keyboard, however, makes data entry convenient. It shares the PET internal keyboard interface, allowing the two keyboards to be used interchangeably. Both are active at all times, allowing the operator to use the PERK keyboard for normal data entry, and PET keyboard for numerics or PET's extensive graphic capabilities.

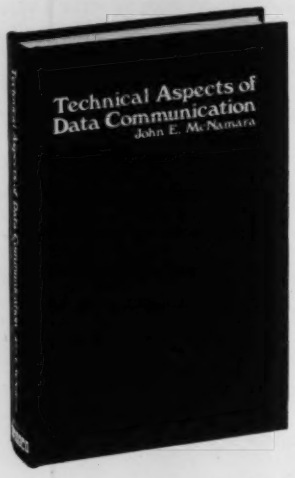
In addition to standard upper-and-lower case alpha characters, with proper shifting the PERK keyboard "alpha-lock" allows easy entry of upper-case-only or "TTY" mode operation. Standard CRT terminal control functions are implemented for cursor control; and full screen editing capabilities are provided.

The addition of the George Risk Industries PERK keyboard makes the PET personal computer ideal for many business, scientific, educational, word processing and personal computing applications. $229.95.

GEORGE RISK INDUSTRIES, INC., GRI Plaza, Kimball NB 69145.

CIRCLE 268 ON READER SERVICE CARD

Now, a book for the practicing professional...



"This is the best handbook of data communications system technology that this reviewer has yet encountered." — Arvid G. Larson in ACM Computing Reviews February 1978

Digital Press announces the publication of TECHNICAL ASPECTS OF DATA COMMUNICATION by John McNamara.

Written for the practicing professional, TECHNICAL ASPECTS OF DATA COMMUNICATION details the nuts-and-bolts problems and solutions in configuring communications systems. It features: • comparison of protocols (DDCMP, BISYNC, SDLC) • extensive explanation of interface standards (CCITT/V.24, RS232C, RS422, RS423) • six comprehensive appendices (how far/how fast?, modem options, codes, UART, format and speed table for asynchronous communication, channel conditioning) • 20 milliampere loop • telephone switching systems • error detection • 382 pages • 125 figures • 70 pages of tables • index • hardcover

digital Digital Press
Educational Services
Digital Equipment Corp.

Dept. DP-H Crosby Drive, Bedford, MA 01730

I would like to order _____ copies of TECHNICAL ASPECTS OF DATA COMMUNICATION at $19.95 per copy.

☐ Check enclosed ☐ Money Order enclosed

Plus $1.00 for Postage and Handling. CC49

Name _____

Address _____

City _____ State _____ Zip _____

Prices apply in U.S. only.

DISCUS 2D S-100 DENSITY DISK SYSTEM

Thinker Toys announces the introduction of DISCUS 2D, a full-size, single/double density disk system capable of storing up to 600K bytes of data on each side of a diskette which is formatted to be compatible with the IBM System 34. Like the original single density DISCUS I, DISCUS 2D comes fully assembled with a controller board and a Shugart SA800R full-size drive mounted in a cabinet with a power supply.

The S-100 controller board utilizes the Western Digital 1791 dual-density controller chip and also has power-on jump circuitry, 1K of RAM, 1K of ROM with built-in monitor, and a hardware UART with a baud rate generator to simplify I/O interfacing. It is capable of handling up to four drives.

Software includes BASIC-V™ virtual disk BASIC, DOS and Disk/Aassembler and editor. Extra cost optional software including CP/M™, Microsoft Extended Disk BASIC and Fortran is available.

The price is $1149 for the completely assembled single/double density system and $795 for each additional drive. Thinker Toys, 1201-10th St., Berkeley CA 94710.

CIRCLE 269 ON READER SERVICE CARD

VENDOR LITERATURE

NEW SCIENCE FAIR® STORY OF ELECTRONICS

An all-new and updated edition of Radio Shack's popular educational comic book, "The New Science Fair Story of Electronics . . . the Discovery that Changed the World!", is now available for free distribution to schools, clubs, youth groups and interested individuals.

The 24-page, full-color booklet traces the development of electronics from ancient times to the present, focusing on the human interest side of science. Important discoveries and the people who made them are described in the easy-to-read narrative.

Topics included are magnetism, ancient use of batteries, electricity in nature, the development of "wireless" communications, TV, radar and the transistor, electronics in aviation and space exploration, and the computer age, plus much more.

The New Science Fair Story of Electronics is available free from participating Radio Shack stores and dealers, nationwide.

CIRCLE 270 ON READER SERVICE CARD

SOFTWARE CATALOG

A new catalog of microcomputer software products has been announced by TSC. Dozens of assembly language programs are described, mainly for the 6800 and 8080 microprocessor. The software includes editors, assemblers, text processors, math packages, games, utilities, and more. Most programs are sold with printed source listing and machine readable object code in the form of disk, cassette, or paper tape. Prices range from $3.75 to $75.00. Catalog: 25¢. Technical Systems Consultants, Inc., P.O. Box 2574, West Lafayette, IN 47906.

CIRCLE 271 ON READER SERVICE CARD

EVERYTHING YOU EVER WANTED TO KNOW ABOUT FLOPPY DISKS

Square One Co., a distributor and manufacturer of floppy disks and supplies has just released a 12 page booklet explaining everything you should know about floppy disks before you either buy them or use them. Entitled, "THE FLOPPY DISK, WHAT YOU SHOULD KNOW," details the care and handling of the media, how to properly mail floppies and how they work.

The booklet is useful for new personnel in office and word processing environments. It helps newcomers feel more comfortable by providing them with knowledge and saves them from the possible embarrassment of ruining a diskette or losing data.

"THE FLOPPY DISK, WHAT YOU SHOULD KNOW" is available, free of charge, from Square One, 614 Eighteenth Ave., Menlo Park CA 94025.

CIRCLE 272 ON READER SERVICE CARD

COMPUTER TERMINALS DIRECTORY

A unique, user-oriented directory of computer terminals has just been published by the Association of Time-Sharing Users (ATSU). With a photograph and a full page of information about each of 120 terminals, the Directory represents over a year's compilation effort by the Association.

What does the Directory contain that is not already provided by other data

processing reference sources on the market? The latest pricing information, a list each terminal's lease costs (when available), the number installed, and information about who to contact at each supplier for further information. A full description of all terminal features is also given.

In bound form, the *Computer Terminals Directory* is $45, prepaid. By subscription, in loose-leaf form, it is part of the Association's three-volume "Interactive Computing Directories," and is available as part of membership in ATSU for $85. Orders for the Directory or for Association membership should be sent to: ATSU, P.O. Box 9003, Boulder CO 80301.

CIRCLE 273 ON READER SERVICE CARD

MICROCOMPUTER EVALUATION SERIES

Management Information Corporation introduces a new series of reports dealing with the evaluation of microcomputer systems—*Business Microcomputer Evaluations*. Each report will contain two complete evaluations of business microcomputers analyzing the equipment, programs, prices, and service capabilities of the manufacturers. These reports are specifically designed to meet the selection needs of the personal computer user and small businessman.

Business Microcomputer Evaluations—I represents the first in this series. The two evaluations contained in this 28 page report are Radio Shack's TRS-80 and the Apple II Computer. Both evaluations describe up-to-date features and capabilities of each of the system. $10 ($15 outside US and Canada).

Management Information Corporation, 140 Barclay Center, Cherry Hill NJ 08034.

CIRCLE 274 ON READER SERVICE CARD

SMALL BUSINESS SOFTWARE

Creative Computer Consultants Inc. announces publication of the Standard Software Library, a series of books containing listings of programs written in BASIC with complete documentation.

Each volume in the series will be devoted to a single application. The first three volumes deal with Accounting Programs for Small Computers. Volume I "General Ledger" enables a small business to set up a fully automated General Ledger system with a complete Chart of Accounts. Included are programs for editing, sorting, merging and posting of transactions. A Trial Balance report is available in either summary or detail at the users option. Income Statement and Balance Sheet reports may be obtained at the close of each accounting period with both current and year to date totals and percentages.

Volume 2 "Accounts Receivable" provides a fully automated system for dealing with customer accounts.

Volume 3 "Payroll" enables a business to automate all of the normal payroll functions.

All of the programs are written in a level of BASIC common to practically all of the current microprocessors and minicomputers. This means that each user can use the programs on an "as is" basis with a minimal effort. At the same time the modular nature of the programs and the accompanying documentation make it easy to revise the program to meet special user requirements.

Volume I "General Ledger" will be available at computer stores or may be ordered direct from Creative Computer Consultants Inc., P.O. Box 2111, Norwalk CT 06852 (203-847-0141) at $49.95.

CIRCLE 275 ON READER SERVICE CARD

FREE GUIDE TO HOME COMPUTERS FROM NCE

A helpful book on the latest and best information about home computers is being offered *free* by NCE/CompuMart, Inc. *Getting Started with Microcomputers* (cover price $2.95) evaluates 25 books and periodicals on current technology and equipment and recommends each for its usefulness to the programmer, engineer or systems designer. This illustrated paperback also includes an up-to-date buyer's guide with current prices and capabilities of today's home computers. It explains what each computer can do for fun—games like baseball, aerial battles, blackjack, scramble and biorhythm analyses—and for household management services like balancing the checkbook and simple bookkeeping. Also details the expansion possibilities of each system. To receive your free copy, write to: NCE/CompuMart, Inc., P.O. Box 8610, Ann Arbor MI 48107.

CIRCLE 276 ON READER SERVICE CARD

THE BEST OF THE PET GAZETTE

This 96-page publication is a treasure trove of information for PET owners. It includes reviews, program listings and hints, interesting tidbits, and advertising from many vendors of PET hardware and software. The reviews are hard-hitting, short, and to the point. Covers topics such as attaching a video monitor to the PET, graphics, program overlays, music, and more. Get one if you don't have all the back issues of the PET Gazette. The PET Gazette, published by Len Lindsay, is a nonprofit organization. The Best of is yours for a donation ($10 suggested). The magazine is free.

The PET Gazette, 1929 Northport Dr., Room 6, Madison WI 53704.

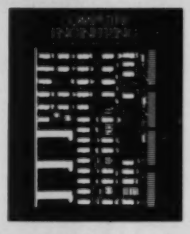
CIRCLE 277 ON READER SERVICE CARD

MAGAZINES, JOURNALS

KIM-1 USER NOTES

KIM-1 USER NOTES, the original 6502 newsletter with over 2100 subscribers worldwide (now known as USER NOTES:6502) is expanding its coverage to include the Synertek SYM and Rockwell

FOR THE SERIOUS STUDENT OF HARDWARE SYSTEMS DESIGN



"This is an excellent book...a major contribution to the literature of computer hardware."
—Gerrit A. Blaauw
Technical University of Twente
Enchede, Netherlands

"...a valuable historical record and a fascinating reference work for engineers and computer scientists to gain insight into the issues and traps of developing and marketing complex products in a fast changing field."
—Jack B. Dennis
Massachusetts Institute of Technology

Computer Engineering: A DEC View of Hardware Systems Design by C. Gordon Bell, J. Craig Mudge, and John E. McNamara is the story of hardware systems design practiced at Digital Equipment Corporation over the past 20 years.

Computer Engineering is written for people who want to or must understand the evaluation of hardware systems design. The focus of the engineer and student of design will be primarily on the highly technical discussions, while that of the manager/planner will be more on the economic and marketplace issues.

The three introductory chapters discuss computer systems from seven different perspectives; technology evolution; packaging and manufacturing. Five major sections follow: "In the Beginning" (transistor circuitry and DEC modules) "The Beginning of the Minicomputer" (18-bit computers, 12-bit computers, and structural levels of the PDP-8), "The PDP-11 Family" (from the beginning of the Family through VAX), "The Evolution of Computer Building Blocks" (RTMs, LSI processor bit slices, and multi-microprocessors), and "The PDP-10 Family." Three appendices cover the ISPS and PMS notations, and measuring computer performance. A bibliography and index are included.

585 pages, 83 tables, 364 figures, hardcover, $19.95, plus $2 for postage and handling (U.S. only).

Send check or money order to: Dept. CE-H, Educational Services, Digital Equipment Corporation, Crosby Drive, Bedford, MA 01730.

digital

I would like to order _____ copy(ies) of *Computer Engineering: A DEC View of Hardware Systems Design.*
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AIM machines and its size to offer twice as much information in a brand new format. KIM will, of course, continue to get the most coverage.

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USER NOTES:6502, Eric C. Rehnke, Publisher, P.O. Box 33093, North Royalton OH 44133.

CIRCLE 278 ON READER SERVICE CARD

TRS-80 Reference Manual

Radio Shack has published a technical reference handbook for their TRS-80 Microcomputer System. The illustrated, 108-page book is intended primarily for technically oriented persons with a good working knowledge of digital logic circuits.

Written in the straightforward, informal manner that has become a hallmark of Radio Shack publications, the TRS-80 Microcomputer Technical Reference Handbook includes technical information and schematic diagrams for both Level-I and Level-II TRS-80 systems.

Topics covered in the book are: Theory of Operation, Adjustments and Troubleshooting, The Outside World (connections to external devices), Parts List and fold-out Schematics.

The TRS-80 Microcomputer Technical Reference Handbook is priced at $9.95. The 8½ x 11" softbound book is available from participating Radio Shack stores and dealers worldwide.

CIRCLE 279 ON READER SERVICE CARD

***VisiCalc*™**

How did you ever do without it? © 1979 PS Inc.

CIRCLE 140 ON READER SERVICE CARD

NEWSLETTER FOR APPLE II OWNERS! RAINBOW

Subscription orders are now being accepted for the independent User Newsletter dedicated to the APPLE II personal computer. The $15.00 subscription price includes all ten issues of volume 1, and the first issue will be available December 1st, 1978. The RAINBOW will include items of interest solely to APPLE II owners! Share discoveries, programs, experiences, innovations, and anecdotes—internationally.

Send subscription orders, articles, letters, software (for review, exchange, or sale) to THE RAINBOW, P.O. BOX 43, AUDUBON, PA 19407. Overseas orders include $10.00 for airmail postage if desired.

CIRCLE 280 ON READER SERVICE CARD

HOW TO FIND THE PERSONAL COMPUTER YOU WANT

Personal computers, once a hobbyist-oriented system, are quickly becoming more and more popular on the small business computer market. Small businessmen have found that personal computers have many of the qualities they seek in a system and are offered at a lower cost than the minicomputer-based system.

Unfortunately, most businessmen know little when it comes to buying a system. Most of the computer 'jargon' is foreign to them, a fact which not only confuses them but might also leave them with a personal computer system that really doesn't satisfy their business needs.

To help these businessmen 'ease' their way into the world of personal computers, as opposed to being 'thrown' in full force, Management Information Corporation has produced a publication which describes those things a potential buyer would want and need to know before purchasing a system.

This 24-page publication, entitled *Personal Computers for the Businessman*, explains what a personal (or micro-) computer is and how it differs from a minicomputer. It also describes a shopping strategy to follow when the decision is made to purchase a system (i.e. don't let the price tag be the only consideration). $7.50. Management Information Corporation, 140 Barclay Center, Cherry Hill NJ 08034.

CIRCLE 281 ON READER SERVICE CARD

THE FIRST NEW ENGLAND MICROCOMPUTER RESOURCE HANDBOOK

Designed as a directory of every resource available in New England, *The Handbook* will list and describe: computers, peripherals, software, retailers, repair organizations, courses, clubs, user groups, user publications, and trade journals. *The Handbook* is another resource of The Boston Computer Society, Boston's information exchange and resource center for the microcomputer industry.

The First New England Microcomputer Resource Handbook, will be useful for many audiences. Home, school, business and laboratory computer users will be able to locate software, user groups, peripherals, user publications and repair services easily. Prospective purchasers will be able to compare costs and features of computers, as well as services and support by local vendors. Novices to the microcomputer phenomenon will have a resource for locating stores, clubs and courses to help further their involvement and understanding. Visitors to the New England area will have a complete list of places to visit. $2.00.

At participating computer stores or by mail from: The Boston Computer Society, 17 Chestnut Street, Boston MA 02108.

CIRCLE 282 ON READER SERVICE CARD

CALCULATORS

CARD-PROGRAMMABLE TEACHING CALCULATORS

EduCALC dual-display lecturer's calculators are available with Hewlett-Packard and Texas Instruments card-programmable "master" calculators. Each unit is an oaken lectern similar in size to a portable typewriter. The master calculator is permanently mounted on top for instructor operation. On the other side, facing the audience, are large neon digits which repeat the calculator's readout with a wide viewing angle and 60-foot legibility.

EduCALC Model 67 GD incorporates the HP-67 fully programmable calculator. It has a Smart Display™ which automatically reformats the 15-digit LED calculator display for the 12 big digits. The new HP-29C continuous-memory programmable is also available on EduCALC Model 29 GD.

The TI Programmables 58 and 59 are built into Models 58 GD an 59 GD; both offer TI's new Solid-State Software modules with up to 5000 steps of program library in each. Model 59 GD can also read and write programs on little magnetic cards; it has up to 960 program steps or 100 data registers. All models carry a full one-year warranty and are supplied with carrying case and owner's manual.

Educational Calculator Devices, Inc., P.O. Box 974, Laguna Beach CA 92652.

CIRCLE 283 ON READER SERVICE CARD

NEW SIX FUNCTION LED DISPLAY WATCH-BALL POINT PEN BY WRITE-TIME

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CIRCLE 284 ON READER SERVICE CARD

TEACHER'S CALCULATOR DISPLAYS HEX AND OCTAL

The EduCALC PG GD is similar in size to a portable typewriter and has two display areas. A built-in Texas Instruments "Programmer" calculator is on top for the instructor's use. A second display of big neon digits faces your audience—it shows the same numbers as does the calculator, with a wide viewing angle and legibility at 60 foot range.

You can use the PG GD as if it showed your students the arithmetic register of a digital computer. It displays hex and octal as well as decimal base numbers, and performs Boolean operations and base conversions. In hex and octal arithmetic it operates naturally, with integer "two's complement," just like a computer.

It handles even IBM 370 problems with ease, and multiplies your effectiveness in teaching programming, debugging, repair, and logic design. An instruction Manual is included. EDUCATIONAL CALCULATOR DEVICES, INC., P.O. Box 974, Laguna Beach CA 92652.

CIRCLE 285 ON READER SERVICE CARD

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The Apple® II, today's most popular personal computer, is at The Computer Store. Along with the latest in Apple peripherals. Like the new Disk™ II floppy disk drive. Or, printer and communications interfaces. And, the latest in software including the new Apple/Dow Jones Stock Quote Reporter. The compact Apple II gives you 48K RAM memory with full color graphics and high resolution graphics. It's the most powerful computer in its price range.

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Phone and mail orders invited. BankAmericard/Visa and Master Charge accepted.

CIRCLE 124 ON READER SERVICE CARD

Notices

Electronic Mail Box

A Washington, DC area electronic mail box is now in operation by the Amateur Radio Research and Development Corporation (AMRAD)—a club of over 200 radio and computer amateurs.

The electronic mail box is an AMI 6800 computer which may be accessed either via telephone line or by means of an amateur radio repeater in McLean, Virginia.

Telephone access is initiated by dialing (703) 281-2125. Any 110 or 300-baud ASCII terminal with standard Bell Telephone model 103 tones (1270 Hz mark, 1070 Hz space) may be used. The user should first type several "returns" to permit the computer to automatically adjust to the user's terminal speed.

Radio access is via the WR4APC 2-meter VHF-FM repeater operating on 147.81 MHz input, 147.21 MHz output. The computer recognizes the call sign WD4IWG when sent using 45-baud (60 wpm) Baudot radioteletype with tones of 2125 Hz (mark) and 2295 Hz (space).

The electronic mail box is similar to the Community Bulletin Board Systems (CBBS) currently in operation:

Atlanta	(404) 458-4886
Chicago	(312) 528-7141
San Diego	(714) 565-0761
Santa Clara	(408) 246-2805

The AMRAD system responds to the following commands:

H—Help
S—Summarize Messages
R—Read
K—Kill Message
F—Find name or subject
M—Memory left
E—Enter Message
G—Goodbye

The system is self teaching and prompts the user for each message element. A hexadecimal serial number is assigned each time the computer is accessed.

Anyone is invited to access the system via telephone lines. Radio access is limited to licensed radio amateurs with Technician or higher class license. Messages of a commercial nature are not permitted because the message may be transmitted over the air via amateur radio where such traffic is prohibited by the Federal Communications Commission. Messages should be kept reasonably brief because messages are stored in 16K RAM. There are plans to expand the memory sometime in the near future, but for the moment the capacity is about 20 to 30 messages. Also, users should "kill" messages addressed to them as soon as they are received.

For additional information, write AMRAD, 1524 Springvale Ave., McLean, VA 22101.

Trade Association Forms In Microcomputer Industry

A trade association is being created to support the growth and development of the microcomputer industry.

Named the Microcomputer Industry Trade Association (MITA), its membership is expected to encompass all segments of what is also called the personal computer industry, including hardware manufacturers, software producers, retailers, system houses, distributors, consultants publishers and others.

The association will bring all of these segments together to solve problems within the industry and to represent their interests to those outside the industry, according to Jim Warren, president of MITA.

"MITA will be involved in issues such as microcomputer shows, interface standards, warranty, service policies, retailer support, legislative action and consumer education, among other things," Warren said.

"These issues are the industry's major concerns and interests based on information gathered through public meetings and an informal survey conducted in the four months of the association's formation," he explained.

He also stated that the association expects to propose membership benefit programs such as group insurance, credit reporting, transportation discounts and others.

Warren is among eleven directors elected during an industry-wide meeting of approximately 140 at the 3rd West Coast Computer Faire November 3. Other formation meetings were held at major microcomputer shows during August in Philadelphia and September in Dallas.

The other directors are Carl Burlin, Byte Shop of Placentia; Jim Brown, Computer Data Systems; John French, consultant; Bill Honeyman, Honeyman & Associates; Shelly Howard, Micro Computer Devices; Bill Langenes, Computer Retailing; Adam Osborne, Osborne & Associates; Neil Otto, Otto Electronics; Vern Raburn, GRT Corp.; and Don Smith, Jade Computer Products. Warren is publisher of Intelligent Machines Journal and chairman of the West Coast Computer Faires. Langenes was elected secretary and Raburn elected treasurer.

Companies wishing to support MITA may send $100 as seed money applicable to membership dues when they are adopted at the May meeting. A check payable to MITA may be sent to Vern Raburn, MITA secretary, c/o GRT Corp., 1286 Lawrence Station Road, Sunnyvale, Calif. 94086.

For more information, contact Jim Warren at (415) 851-7664.

DPMA Sponsors 2nd Annual Student Program And Paper Competition

Data Processing Management Association (DPMA) will be sponsoring its second annual student program and paper competition in connection with its San Diego '79 International Conference and Business Exposition to be held October 14-17, 1979 in the Town & Country Hotel.

James R. Stallard, CDP, Assistant Professor, Information Systems Department, San Diego State University, will chair the student program to be held Sunday, October 14. Program and competition material will be sent to all 140 DPMA student organizations, consisting of nearly 4,000 members, encouraging members to submit papers for the program.

Awards will be presented to the winners in two categories, graduate and undergraduate, at the student program. Each DPMA Region is asked to select one winning paper in both categories and forward them to DPMA International Headquarters. (505 Busse Hwy, Park Ridge, IL 60068) The deadline for the competition is June 1.

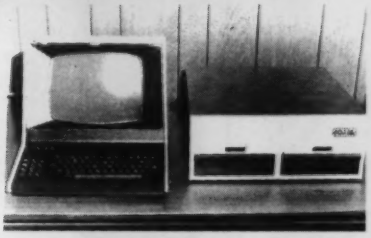
Emphasis in the competition must be placed on subjects in the area of management of data processing activities and the use of data processing in management responsibilities.

Clemson Conference

The Clemson Conference on Small Computers: Applications for Business, Industry, and Everybody will be held at Clemson University, Clemson, S.C. on **May 23 & 24, 1979.** The conference will be of great value to all those who have become interested in small computers but who have a wait-and-see attitude. In addition, people who are already involved with small systems will find the conference highly interesting and beneficial. There will be discussions on a wide variety of applications, tutorials on small systems, and exhibits of equipment. Applications to be discussed are business, industry, engineering, medicine, education, agriculture, and the home. David Ahl of *Creative Computing* will be the keynote speaker.

For registration information contact K. E. Johnson, Continuing Engineering Education, Clemson University, Clemson, S.C. 29631. For information on the applications to be discussed or equipment exhibits, contact W. J. Barnett, Electrical and Computer Engineering Department, Clemson University, Clemson, S.C. 29631.

TAKE A CLOSER LOOK!



THE COMMODORE PET 2001 and a FREE COURSE IN BASIC!

(If you already know BASIC, substitute program of equal value)

Buy the 8K PET and receive FREE, a computerized course in programming! Basic BASIC, by Ralph James, Ph.D., and Ronald Lodewyck, Ph.D. is an extensive series of programs which teach BASIC in a clear, interactive, and dynamic style which is only possible with a computer.

Certain features of the PET continue to place it way ahead of ALL competition:

·Complete screen editing allows INSERTION and DELETION of characters anywhere in the screen listing of a program! No retyping of lines to correct errors.
·6502 Microsoft BASIC continues to be the fastest version available. REAL-TIME animation, REAL-TIME control applications, and numerous time-sensitive applications become possible with Commodore BASIC. The competitors' BASIC's are usually too slow for anything but 'static' programs!
·Completely integrated self contained unit- NO 'rat's nest' of dangling wires and connectors. Single cabinet contains 9"CRT screen with crisp clear resolution, cassette tape drive, 72 key keyboard and separate numeric keypad.
·Rugged heavy-duty steel cabinet-the PET is durable enough for demanding industrial applications, yet makes an attractive addition to the home environment.
·Innovative file control system makes data file handling and 'input/output' operations by the cassette, printer, disk, and other peripherals easy.
·Three optimized methods to expand: 1) memory expansion bus for additional RAM & ROM. 2) IEEE-488 bus for I/O expansion. The IEEE bus allows up to 15 devices 'on-line' simultaneously-ALL connected to the same port. No need for multiple expensive RS-232 or parallel ports! 3) 8 bit parallel I/O port with handshake lines for simpler applications.

The Commodore PET is not perfect, but we are yet to see ANY competition that is as innovative in design, as durable in construction, or as versatile or fun to use as the PET.

8K PET with Basic BASIC programming course (or equiv.) *795
New 16K PET with FACTORY full sized ASCII keyboard, but does not include cassette drive (call, or write to verify) *995
32 K PET with full ASCII keyboard, but w/o cassette *1195
PET Printer-Impact printer with formatted printing, full graphics printing, TRACTOR feed... ..many features *975
PET FLOPPY DISK, dual shugart minifloppy, approx. 330K under internal microprocessor CONTROL—FULL DOS *1095

Prices quoted for new peripherals are preliminary and approx.

The COMPUCOLOR II, The Best Home/Personal Computer Available. Intelligent Systems Corporation of Norcross, Georgia has been building color video graphics terminals for years, and the Compucolor II is based on the same high level software and advanced hardware design of commercial/industrial systems costing thousands of dollars more. The Compucolor II comes with the following STANDARD features!

·Minifloppy disk drive, built-in, with advanced DOS, accessable through BASIC, or stand alone. Sequential, Random files.
·13" color CRT STANDARD- 32x64 characters w/graphics
·16K extended DISK BASIC with FULL graphics capabilities BUILT-IN! No need for extra kluged graphics programs!
·RS-232 port for printer or modem, STANDARD
·Can function as an intelligent terminal for larger system
·72 Key ASCII keyboard standard, with many extra features
·large selection of software on diskette, with more coming
·User group and newsletter

IT MAY BE HARD TO BELIEVE, BUT THE ABOVE SYSTEM WITH 16K USER RAM, 2 FREE DISKETTES (W/4,5 PROGRAMS EACH) IS ONLY *1695!

2nd Minifloppy disk drive, 52K *400
Optional 117 Key keyboard (numeric cluster, etc.) *225
SOFTWARE DISKETTES, *19.95 EACH (contain 4-6 programs each)
Startrek, Othello, Chess, Math Tudor, Sampler (free w/CCII)
Black Jack, Personal Finance 1, Personal Finance 2, Bonds & Securities, Equity.
Personal Data Base *29.95: Text Editor *24.95: Assembler *24.95: Programming manual *25: Maintenance Manual *50.

Write for further details!
Compare with the TRS-80 and Apple II!

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P.O. Box 1712 B
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800-633-8724 (Div. 5C Corp)
Master Charge/Visa: Free UPS Shipping on all orders prepaid with cashier's check (heavy items shipped freight collect)
Unless otherwise stated, all items assembled, tested, warrantied 90 days for parts and labor
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ALTOS ACS-8000 SUN SERIES: a new standard in CP/M based systems

·Single board construction for highest bandwidth, signal purity, reliability, ease of maintenance, and lowest cost.
·4 mhz. Z80 w/32K 200 nanosecond 4116 RAM, sockets for 64K
·Dual Shugart 8" drives-single density/sided standard; double density and/or double sided drives optional.
·28 megabyte hard disk (Shugart) available this summer in matching cabinet.
·Large prototyping board available for custom applications; installs next to main board. (room for 75 16 pin IC's)
·2 accessory AC outlets for printer, terminal, etc.
·2 RS-232 and one 16 bit parallel port standard.
·PASCAL, COBOL, CBASIC, FORTRAN, and Z80 macro assembler
·90 day warranty for parts/labor.

When high bandwidth (high speed), low cost, and reasonable expandability are considered, the price/performance advantages of a single board design far outweigh the advantages of a so called 'standard' bus configuration. Why pay thousands more for lower performance? Altos decided that hardware requirements were adequately met with a single "6x9" board!

ACS-8000-1, 32K, single density/sided (500Kbyte) *3840.00
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additional 16K ram- *99: proto board w/connector *150.00
CP/M free with computer: CBASIC *100.00: Fortran IV *500.00: PASCAL *200.00: COBOL *770.00: Z80 macro assembler *100.00

ALL ITEMS AVAILABLE NOW!

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Hazeltine 1500 with full end-user warranty! (90 day parts, labor, usually ON-SITE, from Hazeltine! *1195
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Printer Cable *35
ALTOS SYSTEM (1), list price *7065
SPECIAL SYSTEM PRICE $6895

Beware of the poor warranties most 'bargain basement' peripherals include! ALL peripherals (unless otherwise stated) from Plainsman Micro Systems include the FULL (usually on-site) WARRANTY and service from the manufacturer.

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CIRCLE 163 ON READER SERVICE CARD

Music Composition:

A Different Approach

Nancy Altmayer

Following the rules of music composition this program randomly composes music in four-part harmony ... free of human intervention after the initial operator input! It's interesting to see the difference in music when the rules are not followed. Nancy Altmayer, who is currently attending Princeton University, developed the program as a term project for a high school computer math class.

Introduction

This program illustrates the possibility of composing music in four-part harmony by using a computer random generator. An algorithm was devised incorporating rules of music composition, and developed on the Honeywell model #1646. The computer output consists of sets of numbers representing notes, chord variations, tempos and voicing. Utilization of the output permits the writing of music. This method of composition is unique from any other published method, in that there is no human intervention after the program has been started.

Program Summary

The I/O device was the Data Access System model #360. The computer used in Honeywell model #1646. This has a main memory of 64K, with 276 disk drives, each with 7½ megabyte capacity. Because of the program size file linkage was necessary which was accomplished by using a 'CHAIN' command.

Through the use of random number generators, chord numbers were selected. These chord numbers were put through a series of tests representing the rules of composition. Chords not fitting into these rules were eliminated. Inversions for these chords were then selected through random generation, breaking them up into definite soprano-alto-tenor — bass arrangements. This being done, random generation was again used to select a tempo for the piece, and finally to assign note values for each chord.

The random number generator 'INT(RND(O)*U)' generates numbers by multiplying an input constant by the number of seconds past midnight. The constant is a truncating factor to yield the desired number of digits.

Musical Description

As a result of different instructions in the program, pieces can be written in either major or minor keys. A selection of one of the four tempos, 4/4, 2/2, 3/4, or 6/8 is made. Each chord has the possibility of being a different value (e.g., a quarter note) and has inversions making up SATB (soprano-alto-tenor-bass) voicing. ■

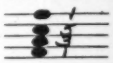
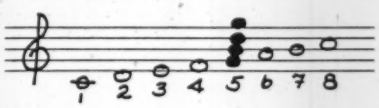
Nancy Altmayer, 442 Pyne Hall, Princeton University, Princeton, NJ 08540, or 549 Greenway East, West Hempstead, NY 11552.

Table 1.
Operating Information
Computer Language - BASIC
File Size - 256 coding lines
Input - keyboard
Starting Code - XBASIC MUSIC
Random generator used
Linkage used - 'CHAIN' Command
Output printer - Data Access Systems #360

Table 2.
Rules of Composition
1) A 4 chord cannot be followed by a 5 or a 3 chord.
2) Two 5 chords cannot be next to each other.
3) The 3 chord cannot follow the 1 chord.

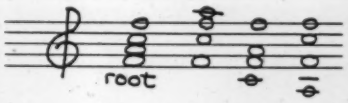
Table 3.
Glossary of Musical Terms

Beats - The temporal unit of a composition, as represented by the up-and-down movement of a conductor's hand. In slow or medium tempo, the 4/4 measure has four beats, the 3/4 has three, the 2/2 has two. In fast tempo there may be only two beats (in 4/4) or even one beat to the measure.

Chord - The simultaneous sounding of three or more tones. In this music program, triads with doubled roots (total of four notes or voices) are used. Ex.

Chord Number - A number assigned a chord depending on its position in the scale. Ex: The 5 chord in the c major scale -

Chord Variation - The transposition of the notes in a chord yield a variation. for a basic triad with a doubled brass note, there are
Pn - 4! - possible variations
2! 2

Harmony - The simultaneous occurrence of musical tones as opposed to melody (i.e., succession of tones). In four-part harmony each note of the chord will denote another voice; soprano, alto, tenor, bass.

Inversion - A term applied to various procedures involving the substitution of higher for lower tones and vice versa. in connection with chords, inversion is effected by transposing one or more of the constituents into a higher (or lower) octave.

Inversions or variations (on chords) - The transposition of the notes within a chord. Ex:

In 'music' the 4 notes were randomly mixed, creating 12 possible variations, since two of the notes were repeated.

Major, Minor Scales - The basic scales of most music heard today are the major and minor scales, both consisting of seven different notes forming five whole tones (w) and two half tones (h), the former in the arrangement wwhwwwh, the later, whwwhww. Starting from C, the tones of the major scale (C Major) are:
C D EF G A BC,
those of the minor (C minor),
C DE F G A BC
(brackets indicate half tones)

Time Signature - A sign given at the beginning of a composition to indicate its meter (time).
Ex: 3 3 to the measure
4 quarter note gets 1 beat

Table 4.
Program Symbols

N(I)	- chosen chord values
I	- chord number
J	- chord number
N(B)	- all chord values
N(S)	- chord values that fall within limits
L	- counter
V(K)	- chord inversions
T(A)	- tempo of piece
E(D)	- chosen note values
S	- counter
R(W)	- file for discarded chord values
C	- counter
E(C)	- note values
Q	- counter, measure carry-over
S	- measure counter
K	- counter
F	- numerical value of notes
T	- number of beats in a measure

Table 5

'MUSIC'
PROGRAM STEPS

INPUT
-Indication of Major or Minor Key
-Number of Notes Desired
Random Generation of Chrod Values
elimination of incorrect chords
-Chord Sequence to Follow Rules of Composition
-Misplaced Chords Erased
INVERSION OF CHORDS
-Random Generation
-Inversions Become 4-Part Harmony of Piece
TIME SIGNATURES RANDOMLY GENERATED
-Choice of Four Different Tempos
4/4, 2/2, 6/8, 3/4
NOTE VALUES RANDOMLY GENERATED
TRANSFER TO STAFF PAPER

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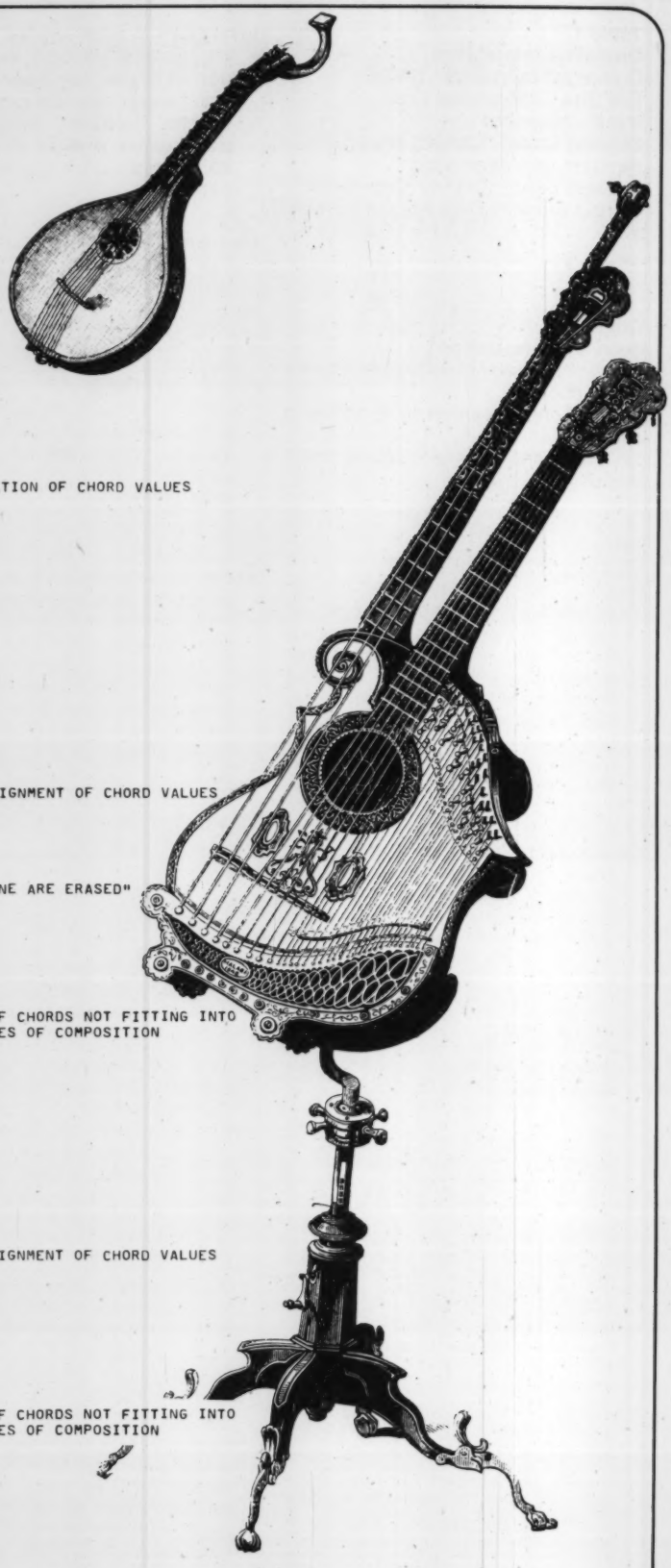
Lincoln, Harvey B., *The Computer and Music,* Cornell University Press, Ithaca, New York, 1970.

Pinkerton, Richard C., "Information Theory and Melody", Scientific American, February 1956, pp. 77-86.

Program A *Program listings for Music Composition*



```
?LIST MUSIC

 10 DIM N(300),R(300),V(300),T(300),E(300)
 20 PRINT "NANCY ALTMAYER"
 30 PRINT "TERM PROJECT"
 40 PRINT "MUSIC COMPOSITION BY COMPUTERS"
 50 FILES MELODY
 60 INPUT P
 70 REM IF A MAJOR KEY IS WANTED, INPUT 8
 80 REM IF A MINOR KEY IS WANTED, INPUT 9
 90 S=0
100 I=RND(TIM(6))
110 B=1                                  RANDOM GENERATION OF CHORD VALUES
120 I=0
130 W=0
135 Q=0
140 L=1
150 U=P
160 INPUT G
170 U=P
180 PRINT TAB(10);"I";TAB(16);"N(I)"
190 PRINT
200 FOR Y=1,G
210 FOR X=1,10
220 B=B+1
230 N(B)=INT(RND(0)*U)
240 NEXT X
250 IF N(B)>U THEN 370
260 IF N(B)<L THEN 370
261 Q=Q+1
262 IF Q=(G+1) THEN 400
270 S=S+1                                TEMPORARY ASSIGNMENT OF CHORD VALUES
280 N(S)=N(B)
290 PRINT TAB(5);S;TAB(12);N(S)
300 NEXT Y
310 PRINT
320 PRINT "S="S
330 PRINT "THERE WILL BE"S+1"NUMBER OF CHORDS IF NONE ARE ERASED"
340 L=S+1
350 REM THIS WILL GIVE ME I+1 NUMBER OF CHORDS
360 GO TO 400
370 W=W+1
380 R(W)=N(B)
390 GO TO 210
400 S=S+1
410 I=S                                  ELIMINATION OF CHORDS NOT FITTING INTO
420 J=S                                        RULES OF COMPOSITION
430 N(I)=1
440 PRINT TAB(10);"J";TAB(16);"N(I)";TAB(25);"I"
450 PRINT TAB(5);J;TAB(12);N(I);TAB(20);I
460 PRINT
470 S=S-1
480 IF N(S)=3 THEN 500
490 GO TO 550
500 W=W+1
510 R(W)=N(S)
520 GO TO 470
530 REM I AM WRITING MY COMPOSITION BACKWARDS
540 REM THE "1" CHORD WILL BE FIRST
550 I=I-1
560 J=J-1                                PERMANENT ASSIGNMENT OF CHORD VALUES
570 N(I)=N(S)
580 PRINT TAB(5);J;TAB(12);N(I);TAB(20);I
581 PRINT
590 IF S=1 THEN 840
600 IF N(S)=4 THEN 650
610 IF N(S)=5 THEN 720
620 IF N(S)=1 THEN 780
630 S=S-1
640 GO TO 550
650 S=S+1                                ELIMINATION OF CHORDS NOT FITTING INTO
660 IF N(S)=3 THEN 690                         RULES OF COMPOSITION
670 IF N(S)=5 THEN 670
680 GO TO 550
690 W=W+1
700 R(W)=N(S)
710 GO TO 650
720 S=S-1
730 IF N(S)=5 THEN 750
740 GO TO 550
750 W=W+1
```

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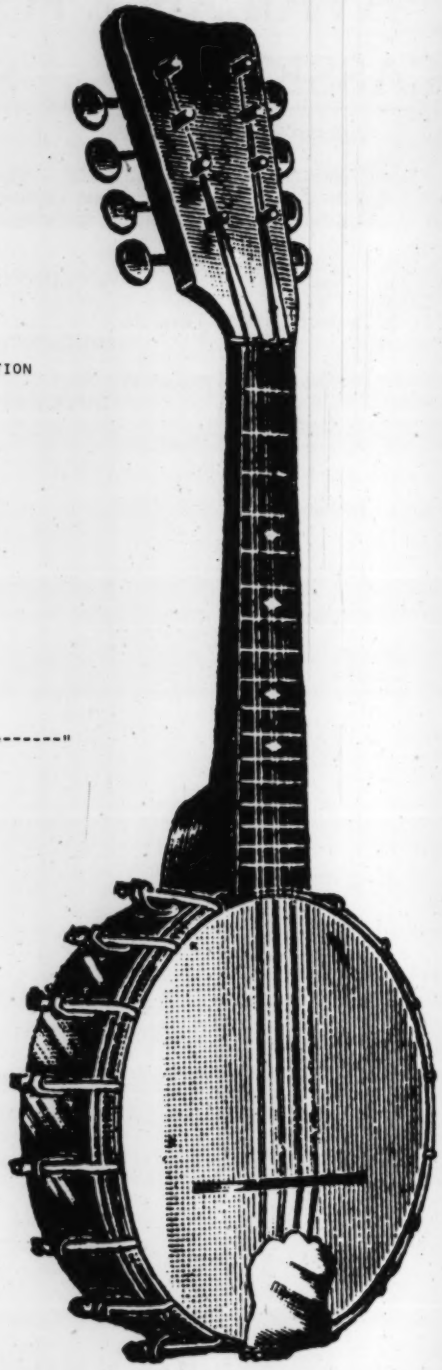
CIRCLE 136 ON READER SERVICE CARD

```
760 R(W)=N(S)
770 GO TO 720
780 S=S-1
790 IF N(S)=3 THEN 810
800 GO TO 550
810 W=W+1
820 R(W)=N(S)
830 GO TO 780
840 PRINT "I="I
841 PRINT
850 J=1                                  PRINTING OF CHORD ASSIGNMENTS
860 N=1
869 PRINT TAB(10);"J";TAB(16);"N(I)";TAB(25);"I"
870 PRINT TAB(5);J;TAB(12);N(I);TAB(20);I
880 PRINT
890 IF I=L THEN 940
900 I=I+1
910 J=J+1
920 N=N+1
930 GO TO 870
940 PRINT "N"=N
950 PRINT "CHORD VARIATION"
960 PRINT
970 M=0
980 C=1
990 H=1
1000 PRINT TAB(10);"K";TAB(16);"V(K)"
1012 D=12
1020 J=0
1030 I=0
1040 K=0
1050 FOR Y=1,N                           RANDOM GENERATION OF CHORD VARIATION
1060 FOR X=1,10
1070 C=C+1
1080 J=J+1
1090 I=I+1
1100 V(C)=INT(RND(0)*D)
1110 NEXT X
1120 IF V(C)<H THEN 1220
1130 IF V(C)>D THEN 1220
1140 K=K+1
1150 V(K)=V(C)
1160 PRINT TAB(5);K;TAB(12);V(K)
1170 NEXT Y
1180 PRINT
1190 PRINT "K=L="K
1200 L=K
1210 GO TO 1250
1220 M=M+1
1230 F(M)=V(C)
1240 GO TO 1060
1250 PRINT TAB(7);"J";TAB(12);"N(I)";TAB(20);"V(K)";TAB(27);"S";
1260 PRINT TAB(32);"A";TAB(37);"T";TAB(42);"B"
1270 PRINT "-----------------------------------------------------------------"
1280 PRINT
1290 PRINT
1300 J=0
1310 I=0
1320 K=0
1330 IF J=L THEN 1960                    ASSIGNMENT OF CHORD VARIATIONS
1340 J=J+1
1350 I=I+1
1360 K=K+1
1370 IF N(I)=7 THEN 1900
1380 IF N(I)=8 THEN 1930
1390 REM THERE ARE 12 POSSIBLE VARIATIONS
1391 IF V(K)>6 THEN 1400
1395 ON V(K) GO TO 1430,1470,1510,1550,1590,1630
1400 V(Z)=V(K)-6
1405 ON V(Z) GO TO 1670,1710,1750,1790,1830,1870
1410 REM THE NUMBERS FOLLOWING THE V(K) INDICATE THE POSITIONS OF
1420 REM THE NOTES IN THE CHORDS
1429 REM INVERSION V(K)=1
1430 PRINT TAB(2);J;TAB( 8);N(I);TAB(16);V(K);TAB(22);"3";TAB(27);"1";
1440 PRINT TAB(32);"5";TAB(37);"1"
1450 PRINT
1460 GO TO 1330
1469 REM INVERSION V(K)=2
1470 PRINT TAB(2);J;TAB( 8);N(I);TAB(16);V(K);TAB(22);"1";TAB(27);"5";
1480 PRINT TAB(32);"3";TAB(37);"1"
1490 PRINT
1500 GO TO 1330
1509 REM INVERSION V(K)=3
1510 PRINT TAB(2);J;TAB( 8);N(I);TAB(16);V(K);TAB(22);"5";TAB(27);"1";
1520 PRINT TAB(32);"3";TAB(37);"1"
1530 PRINT
1540 GO TO 1330
1549 REM INVERSION V(K)=4
1550 PRINT TAB(2);J;TAB( 8);N(I);TAB(16);V(K);TAB(22);"3";TAB(27);"5";
1560 PRINT TAB(32);"3";TAB(37);"1"
1570 PRINT
1580 GO TO 1330
1589 REM INVERSION V(K)=5
1590 PRINT TAB(2);J;TAB( 8);N(I);TAB(16);V(K);TAB(22);"5";TAB(27);"1";
1600 PRINT TAB(32);"3";TAB(37);"1"
1610 PRINT
1620 GO TO 1330
1629 REM INVERSION V(K)=6
1630 PRINT TAB(2);J;TAB( 8);N(I);TAB(16);V(K);TAB(22);"1";TAB(27);"3";
1640 PRINT TAB(32);"5";TAB(37);"1"
```



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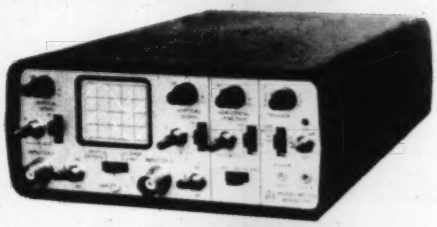

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CIRCLE 111 ON READER SERVICE CARD

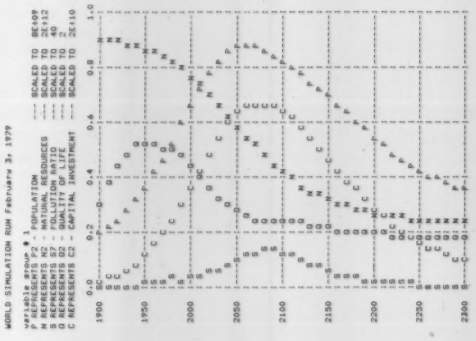
```
1650 PRINT
1660 GO TO 1330
1669 REM INVERSION V(K)=7   V(Z)=1
1670 PRINT TAB(2);J;TAB( 8);N(I);TAB(16);V(K);TAB(22);"1";TAB(27);"1";
1680 PRINT TAB(32);"5";TAB(37);"3"
1690 PRINT
1700 GO TO 1330
1709 REM INVERSION V(K)=8   V(Z)=2
1710 PRINT TAB(2);J;TAB( 8);N(I);TAB(16);V(K);TAB(22);"1";TAB(27);"5";
1720 PRINT TAB(32);"3";TAB(37);"1"
1730 PRINT
1740 GO TO 1330
1749 REM INVERSION V(K)=9   V(Z)=3
1750 PRINT TAB(2);J;TAB( 8);N(I);TAB(16);V(K);TAB(22);"5";TAB(27);"1";
1760 PRINT TAB(32);"3";TAB(37);"1"
1770 PRINT
1780 GO TO 1330
1789 REM INVERSION V(K)=10   V(Z)=4
1790 PRINT TAB(2);J;TAB( 8);N(I);TAB(16);V(K);TAB(22);"1";TAB(27);"1";
1800 PRINT TAB(32);"3";TAB(37);"5"
1810 PRINT
1820 GO TO 1330
1829 REM INVERSION V(K)=11   V(Z)=5
1830 PRINT TAB(2);J;TAB( 8);N(I);TAB(16);V(K);TAB(22);"1";TAB(27);"3";
1840 PRINT TAB(32);"1";TAB(37);"5"
1850 PRINT
1860 GO TO 1330
1869 REM INVERSION V(K)=12   V(Z)=6
1870 PRINT TAB(2);J;TAB( 8);N(I);TAB(16);V(K);TAB(22);"3";TAB(27);"1";
1880 PRINT TAB(32);"1";TAB(37);"5"
1890 PRINT
1895 GO TO 1330
1900 PRINT TAB(2);J;TAB( 9);"REST"
1910 PRINT
1920 GO TO 1330
1930 PRINT TAB(2);J;TAB( 9);"HOLD"
1940 PRINT
1950 GO TO 1330
1960 WRITE #1,B,I,W,L,U,J,C,K,M,D
1970 CHAIN "XBASIC MUSIC3"
```

```
  ?LIST MUSIC2
2643 PRINT "J="J
2645 GO TO 2672
2646 PRINT "T="T                                  ASSIGNMENT OF NOTE VALUES ACCORDING TO
2647 J=0                                                TEMPOS
2648 PRINT TAB(11);"T";TAB(18);"F"
2651 ON T(A) GO TO 2680:3130:3600:4070
2660 REM THIS WILL ASSIGN MEASURES DEPENDING ON THE VALUE OF T(A)
2670 D=0
2671 GO TO 2680
2672 D=0
2673 D=D+1
2674 PRINT D;E(D)
2675 IF D=J THEN 2646
2676 GO TO 2673
2680 S=0
2685 D=0
2690 IF J=L THEN 3050
2700 D=D+1
2710 I=I+1
2720 J=J+1
2730 K=K+1
2735 PRINT "E(D)="E(D)
2740 IF E(D)=1 THEN 2750
2741 IF E(D)=2 THEN 2780
2742 IF E(D)=3 THEN 2810
2743 IF E(D)=4 THEN 2840
2744 IF E(D)=5 THEN 2870
2745 IF E(D)=6 THEN 2900
2750 S=S+4
2760 F=4
2770 GO TO 2920
2780 S=S+2
2790 F=2
2800 GO TO 2920
2810 S=S+1
2820 F=1
2830 GO TO 2920
2840 S=S+.5
2850 F=.5
2860 GO TO 2920
2870 S=S+.25
2880 F=.25
2890 GO TO 2920
2900 S=S+.125
2910 F=.125
2920 IF S>T THEN 3000
2930 IF S=T THEN 2970
2940 PRINT TAB(6);J;TAB(13);F
2950 PRINT
2960 GO TO 2690
2970 PRINT TAB(6);J;TAB(13);F;TAB(20);"END OF MEASURE"
2980 PRINT
2990 GO TO 2680
3000 Q=S-T
3010 PRINT TAB(6);J;TAB(13);F;TAB(20);"END OF MEASURE +"Q
3020 PRINT
```

```
3030 S=Q
3040 GO TO 2690
3050 PRINT "IN 4/4 TIME,"
3060 PRINT "F=4    INDICATES A WHOLE NOTE"
3070 PRINT "F=2    INDICATES A HALF NOTE"
3080 PRINT "F=1    INDICATES A QUARTER NOTE"
3090 PRINT "F=.5   INDICATES AN EIGTH NOTE"
3100 PRINT "F=.25 INDICATES A SIXTEENTH NOTE"
3110 PRINT "F=.125 INDICATES A THIRTY-SECOND NOTE"
3120 GO TO 4530
3130 D=0
3140 S=0
3150 IF J=L THEN 3520
3160 D=D+1
3170 I=I+1
3180 J=J+1
3190 K=K+1
3195 PRINT "E(D)="E(D)
3200 IF E(D)=1 THEN 3210
3201 IF E(D)=2 THEN 3240
3202 IF E(D)=3 THEN 3270
3203 IF E(D)=4 THEN 3300
3204 IF E(D)=5 THEN 3330
3205 IF E(D)=6 THEN 3360
3210 S=S+2
3220 F=2
3230 GO TO 3390  ASSIGNMENT OF NOTE VALUES FOR 2/2 TEMPO
3240 S=S+1
3250 F=1
3260 GO TO 3390
3270 S=S+.5
3280 F=.5
3290 GO TO 3390
3300 S=S+.25
3310 F=.25
3320 GO TO 3390
3330 S=S+.125
3340 F=.125
3350 GO TO 3390
3360 S=S+.0625
3370 F=.0625
3380 GO TO 3390
3390 IF S>T THEN 3470
3400 IF S=T THEN 3440
3410 PRINT TAB(2);J;TAB( 9);F
3420 PRINT
3430 GO TO 3150
3440 PRINT TAB(6);J;TAB(13);F;TAB(20);"END OF MEASURE"
3450 PRINT
3460 GO TO 3140
3470 Q=S-T
3480 PRINT TAB(6);J;TAB(13);F;TAB(20);"END OF MEASURE +"Q
3490 PRINT
3500 S=Q
3510 GO TO 3150
3520 PRINT "IN 2/2 TIME,"
3530 PRINT "F=2     INDICATES A WHOLE NOTE"
3540 PRINT "F=1     INDICATES A HALF NOTE"
3550 PRINT "F=.5    INDICATES A QUARTER NOTE"
3560 PRINT "F=.25   INDICATES AN EIGTH NOTE"
3570 PRINT "F=.125 INDICATES A SIXTEENTH NOTE"
3580 PRINT "F=.0625 INDICATES A THIRTY-SECOND NOTE"
3590 GO TO 4530
3600 D=0
3610 S=0
3620 IF J=L THEN 3990
3630 D=D+1
3640 I=I+1
3650 J=J+1
3660 K=K+1
3665 PRINT "E(D)="E(D)
3670 IF E(D)=1 THEN 3680
3671 IF E(D)=2 THEN 3710
3672 IF E(D)=3 THEN 3740
3673 IF E(D)=4 THEN 3770
3674 IF E(D)=5 THEN 3800
3675 IF E(D)=6 THEN 3830
3680 S=S+3
3690 F=3
3700 GO TO 3860
3710 S=S+1.5
3720 F=1.5
3730 GO TO 3860  ASSIGNMENT OF NOTE VALUES FOR 3/4 TEMPO
3740 S=S+.75
3750 F=.75
3760 GO TO 3860
3770 S=S+.375
3780 F=.375
3790 GO TO 3860
3800 S=S+.1875
3810 F=.1875
3820 GO TO 3860
3830 S=S+.09375
3840 F=.09375
3850 GO TO 3860
3860 IF S>T THEN 3940
3870 IF S=T THEN 3910
3880 PRINT TAB(2);J;TAB( 9);F
3890 PRINT
3900 GO TO 3620
```

WORLD SIMULATION

by James L. Murphy, Ph.D.



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CIRCLE 104 ON READER SERVICE CARD

```
3910 PRINT TAB(6);J;TAB(13);F;TAB(20);"END OF MEASURE"
3920 PRINT
3930 GO TO 3610
3940 Q=S-T
3950 PRINT TAB(6);J;TAB(13);F;TAB(20);"END OF MEASURE +"Q
3960 PRINT
3970 S=Q
3980 GO TO 3620
3990 PRINT "IN 3/4 TIME,"
4000 PRINT "F=3     INDICATES A WHOLE NOTE"
4010 PRINT "F=1.5   INDICATES A HALF NOTE"
4020 PRINT "F=.75   INDICATES A QUARTER NOTE"
4030 PRINT "F=.375 INDICATES AN EIGHTH NOTE"
4040 PRINT "F=.1875 INDICATES A SIXTEENTH NOTE"
4050 PRINT "F=.09375 INDICATES A THIRTY-SECOND NOTE"
4060 GO TO 4530
4070 D=0
4071 PRINT "HI"
4080 S=0
4090 IF J=L THEN 4460
4100 D=D+1
4110 I=I+1
4120 J=J+1
4130 K=K+1
4135 PRINT "E(D)="E(D)
4140 IF E(D)=1 THEN 4150
4142 IF E(D)=2 THEN 4180
4143 IF E(D)=3 THEN 4210
4144 IF E(D)=4 THEN 4240
4145 IF E(D)=5 THEN 4270
4146 IF E(D)=6 THEN 4300
4150 S=S+6
4160 F=6
4170 GO TO 4330
4180 S=S+3
4190 F=3
4200 GO TO 4330     ASSIGNMENT OF NOTE VALUES FOR 6/8 TEMPO
4210 S=S+1.5
4220 F=1.5
4230 GO TO 4330
4240 S=S+.76
4250 F=.76
4260 GO TO 4330
4270 S=S+.38
4280 F=.38
4290 GO TO 4330
4300 S=S+.19
4310 F=.19
4320 GO TO 4330
4330 IF S>T THEN 4410
4340 IF S=T THEN 4380
4350 PRINT TAB(2);J;TAB( 9);F
4360 PRINT
4370 GO TO 4090
4380 PRINT TAB(6);J;TAB(13);F;TAB(20);"END OF MEASURE"
4390 PRINT
4400 GO TO 4080
4410 Q=S-T
4420 PRINT TAB(6);J;TAB(13);F;TAB(20);"END OF MEASURE +"Q
4430 PRINT
4440 S=Q
4450 GO TO 4090
4460 PRINT "IN 6/8 TIME,"
4470 PRINT "F=6     INDICATES A WHOLE NOTE"
4480 PRINT "F=3     INDICATES A HALF  NOTE"
4490 PRINT "F=1.5   INDICATES A QUARTER NOTE"
4500 PRINT "F=.76   INDICATES AN EIGHTH NOTE"
4510 PRINT "F=.38   INDICATES A SIXTEENTH NOTE"
4520 PRINT "F=.19   INDICATES A THIRTY-SECOND NOTE"
4530 RETURN

?LIST MUSIC3

2000 FILES MELODY,MELOD2
2010 READ #1,B,I,W,L,U,J,C,K,M,D
2015 DIM E(300),T(300)
2020 W=RND(TIM(6))
2030 C=1
2040 U=4
2050 A=0                    RANDOM GENERATION OF TEMPO
2060 A=A+1
2070 T(A)=INT(RND(0)*U)
2080 IF T(A)>U THEN 2060
2090 IF T(A)<C THEN 2060
2100 PRINT "T(A)="T(A)
2110 PRINT
2120 I=0
2130 K=0
2140 ON T(A) GO TO 2170,2220,2270,2320
2150 REM LN 1150 WILL PRINT THE TEMPO OF THE COMPOSITION
2160 REM THE FOUR MOST COMMON TEMPOS ARE USED
2170 PRINT TAB( 8);"THE TEMPO OF THE PIECE IS 4/4 TIME"
2180 PRINT TAB( 8);"-----------------------------------"
2190 PRINT
2195 T(A)=1
2200 T=4
2210 GO TO 2380
2220 PRINT TAB( 8);"THE TEMPO OF THIS PIECE IS 2/2 TIME"
2230 PRINT TAB( 8);"-----------------------------------"
2240 PRINT
```

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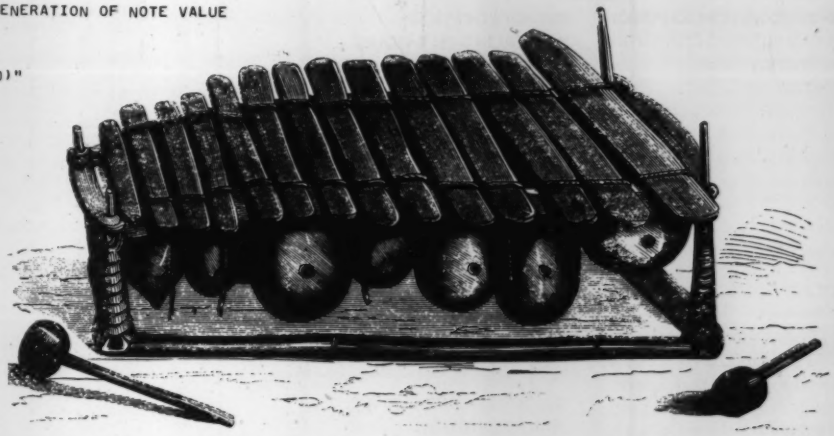
CIRCLE 115 ON READER SERVICE CARD

```
2245 T(A)=2
2250 T=3
2260 GO TO 2380
2270 PRINT TAB( 8);"THE TEMPO OF THE PIECE IS 3/4 TIME"
2280 PRINT TAB( 8);"-----------------------------------"
2290 PRINT
2295 T(A)=3
2300 T=2
2310 GO TO 2380
2320 PRINT TAB( 8);"THE TEMPO OF THE PIECE IS 6/8 TIME"
2330 PRINT TAB( 8);"-----------------------------------"
2340 PRINT
2345 T(A)=4
2348 T=1
2360 GO TO 2380
2380 B=RND(TIM(6))
2390 N=1
2410 U=6
2415 W=0
2416 Q=0
2420 C=0                    RANDOM GENERATION OF NOTE VALUE
2430 D=0
2440 PRINT "J=";J
2441 PRINT
2445 PRINT TAB( 7);"D";TAB(13);"E(D)"
2450 FOR Y=1,J
2460 FOR X=1,10
2470 C=C+1
2480 E(C)=INT(RND(0)*U)
2500 IF E(C)>U THEN 2590
2510 IF E(C)<N THEN 2590
2511 Q=Q+1
2512 IF Q=(J+1) THEN 2631
2530 D=D+1
2540 E(D)=E(C)
2550 PRINT TAB(2);D;TAB( 9);E(D)
2555 NEXT X
2560 PRINT
2570 NEXT Y
2580 GO TO 2631
2590 W=W+1
2600 R(W)=E(C)
2610 GO TO 2460
2631 PRINT
2632 PRINT "T=";T
2641 CALL MUSIC2
2642 STOP
```



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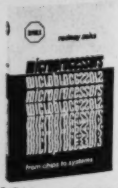

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CIRCLE 178 ON READER SERVICE CARD

Program B *Program for generating sample composition in F Major (see Figure 1).*

```
?XBASIC MUSIC
RUN
NANCY ALTMAYER
TERM PROJECT
MUSIC COMPOSITION BY COMPUTERS
!8
!15
          I       N(I)

          1         1
          2         1
          3         7
          4         7
          5         4
          6         7
          7         6
          8         7
          9         3
         10         5
         11         2
         12         7
         13         7
         14         4
         15         2

S=    15
THERE WILL BE   16   NUMBER OF CHORDS IF NONE ARE ERASED
          J       N(I)      I
         16         1       16

         15         2       15

         14         4       14

         13         7       13

         12         7       12

         11         2       11

         10         5       10

          9         3        9

          8         7        8

          7         6        7

          6         7        6

          5         4        5

          4         7        4

          3         7        3

          2         1        2

          1         1        1

I=  1

          J       N(I)      I
          1         1        1

          2         1        2

          3         7        3

          4         7        4

          5         4        5

          6         7        6

          7         6        7

          8         7        8

          9         3        9

         10         5       10

         11         2       11

         12         7       12

         13         7       13

         14         4       14

         15         2       15

         16         1       16
```

CHORD VARIATION

K	V(K)
1	4
2	10
3	3
4	7
5	4
6	5
7	9
8	4
9	8
10	9
11	6
12	5
13	1
14	10
15	7
16	10

K=L= 16

J	N(I)	V(K)	S	A	T	B
1	1	4	3	5	3	1
2	1	10	1	1	3	5
3	REST					
4	REST					
5	4	4	3	5	3	1
6	REST					
7	6	9	5	1	3	1
8	REST					
9	3	8	1	5	3	1
10	5	9	5	1	3	1
11	2	6	1	3	5	1
12	REST					
13	REST					
14	4	10	1	1	3	5
15	2	7	1	1	5	3
16	1	10	1	1	3	5

```
RUN
T(A)=  1
```

THE TEMPO OF THE PIECE IS 4/4 TIME

```
J= 16
```

D	E(D)
1	2
2	4
3	1
4	2
5	1
6	1
7	2
8	5
9	1
10	5
11	1
12	2
13	1
14	2
15	4
16	4

```
T=  4
J= 16
```

1	2
2	4
3	1
4	2
5	1
6	1
7	2
8	5
9	1
10	5
11	1
12	2
13	1
14	2
15	4
16	4

```
T=     4
E(D)=     T       F
          2
          1       2

E(D)=     4
          2       .5

E(D)=     1
          3       4 END OF MEASURE+   2.5

E(D)=     2
          4       2 END OF MEASURE+   .5

E(D)=     1
          5       4 END OF MEASURE+   .5

E(D)=     1
          6       4 END OF MEASURE+   .5

E(D)=     2
          7       2

E(D)=     5
          8       .25

E(D)=     1
          9       4 END OF MEASURE+   2.75

E(D)=     5
         10       .25

E(D)=     1
         11       4 END OF MEASURE+   3

E(D)=     2
         12       2 END OF MEASURE+   1

E(D)=     1
         13       4 END OF MEASURE+   1

E(D)=     2
         14       2

E(D)=     4
         15       .5
E(D)=     4
         16       .5END OF MEASURE

IN 4/4 TIME.
F=4     INDICATES A WHOLE NOTE
F=2     INDICATES A HALF NOTE
F=1     INDICATES A QUARTER NOTE
F=.5    INDICATES AN EIGTH NOTE
F=.25   INDICATES A SIXTEENTH NOTE
F=.125  INDICATES A THIRTY-SECOND NOTE

2642 EXIT
```
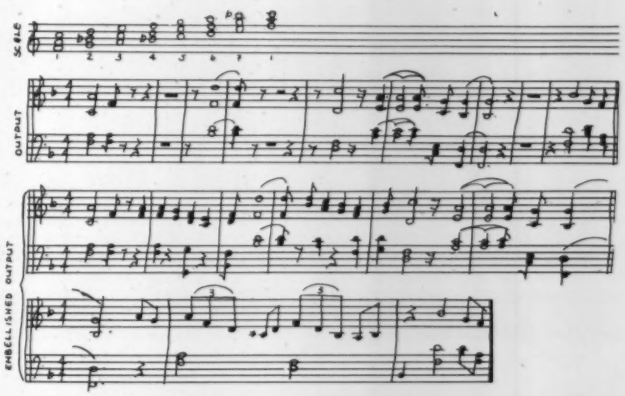
Figure 1. Sample composition in F Major (after transcribing from computer printout to staff paper). Also see Program B.

A ROMAN'S ASSIGNMENT PROBLEM

John M. Anderson

One of the classical problems encountered by students of computer applications is that of how to assign or match one group of objects to another group of objects in the best possible way. Dubbed the "assignment problem," a procedure for solving the problem was developed almost fifty years ago by the Hungarian mathematician E. Egervary. Our purpose here is to tantalize the dabbler in algorithms with a challenge to discover further applications of this amazing "Hungarian Algorithm."

Consider the problem of Dilirius the Roman promoter—namely that of matching mean and nasty gladiators against wild and vicious beasts in the Coliseum of ancient Rome. A good contest was appreciated by the affluent Romans who demonstrated their pleasure with cheers and a shower of coins on the winner, who later split the loot with the promoter; unless of course the winner was a dumb animal, in which case the promoter was left to handle all of the winnings. A poor contest was met with booing and whistling and a shower of less valuable missiles such as half-eaten pizzas. On a given day, Dilirius tried his best to provide a group of contests which pleased the crowd which he hoped would increase the total loot thrown and with it his share.

It was clear to Dilirius that the weight of a spectator's purse at the end of the day was directly related to the total

John M. Anderson, Department of Business and Economics, University of North Carolina at Wilmington, Wilmington, North Carolina 28406

level of his booing for all of the contests, so he sought to match the gladiators and animals in such a way that the overall level of booing was kept to a minimum. As a first step toward solving the problem, Dilirius used his judgement and an arbitrary numerical scale of one to one-thousand to estimate the level of booing that would result from a particular match. For example, if he matched Clodius and a frothing opossum, his estimate might have been recorded as "Booing CCCMX LVII." (The reader should not confuse the arbitrary heuristic described here with the more refined concepts of Boolean algebra.) Estimates for all possible matches were scratched on a clay tablet, an example of which appears below:

Figure I
SAMPLE BOOING TABLET*

TABLET OF BOOS	OPOSSUM	LION	WILDEBEEST	TIGER
CLODIUS	6	2	8	4
GAUDIUS	5	9	4	3
PLODIUS	5	12	8	9
SNODIUS	15	30	20	18

*Ratings are translated to Arabic sympols for this example. They are further expressed in hundreds.

If he chose the matches in such a way that the total of all booing for the day was a minimum, then it was likely that the spectators' purses were as light as possible at the end of the day and he was quite well off indeed. On the other hand, a group of matches which increased the total level of booing reduced the promoter's returns. Dilirius studied the tablet shown in Figure I and began in row 1 matching Clodius with the lion, thereby minimizing the boos for that match. Moving to row 2, he matched Gaudius with the tiger which again kept the boos to a minimum for a match. Plodius was then matched with the opossum and Snodius was left with the wildebeest. This rather simple method of solving the problem resulted in a total booing level of 30. It seemed natural to Dilirius to start in the upper left-hand corner of the tablet (northwest corner) and work his way down, row by row. Such an approach to finding quick and easy solutions is still widely used in many such problems. In fact, over the years this algorithm has come to be known as the "Greedy Algorithm." (I have often wondered if it was named for Horace Greedy...I seem to recall a famous admonishment: "Go northwest young man!" Alas, the name really comes from the manner in which you move systematically through the tablet, grabbing greedily the best matches you can as you go.)

As it turns out, Dilirius could have scheduled the matches in Figure I with a total booing level of 28, thus bringing him a few more mites. Using trial and error on a small problem such as this, even the wildebeest could have found the best set of matches. Try your hand at it...

Clodius vs. _____ =____boos
Poldius vs. _____ =____ boos
Gaudius vs. _____ =____ boos
Snodius vs. _____ =____ boos
Total Boos=_____boos

On more festive occasions such as the Caesar's birthday, Dilirius was faced with scheduling as many as twenty matches. Such a list of matches could be scheduled in over 2,430,000,000,000,000,000 ways! Even the penurious Dilirius could not evaluate all possible schedules for this event. If he could evaluate one different schedule each second (which is unlikely), it would take him over 77,000,000,000 years to finish the job—and that's without taking a break for wine! Unfortunately for Dilirius, more than two thousand years passed before an easy way of selecting the best tournament schedule emerged. Let's look at how modern promoters might solve such a problem.

To begin, assume that no wild beast was compelled to combat more than one wild gladiator and vice versa. Therefore, a schedule always consisted of a single entry in each row and each column of the booing table. Since there must be one entry chosen in each row (or column), we can conclude that it is the relationship between those entries that must be important to the problem and not the absolute size of any particular entry. Therefore, we can reduce all of the entries in a row (or column) by the same amount without disturbing the relationships between those entries—the smallest before the reduction is still the smallest after the reduction; the largest before the reduction is still the largest after the reduction; and so forth. Also, notice that the relationship between rows and columns is not disturbed. If we systematically reduce each row and column by an amount equal to the smallest element in a row or column, then we will produce a new table of what could be called "relative boos." In fact, there will be at least one element in each row and column which represents zero relative boos.

If we could find a set of those zeroes which made up a complete schedule of matches, then we would have a total of zero relative boos for all of the matches. That would certainly be the best we could do. The Hungarian Algorrithm systematically reduces the entries in the table until the table contains the minimum number of zero entries needed for the construction of a zero-relative-boo schedule, and then identifies such a schedule.

This writer's program, which is based upon a modified version of the Hungarian Algorithm developed by J. Munkres, is listed below. The program, called ASSIGN, is written in Hewlett-Packard BASIC. A sample run solving the problem in Figure I follows the program listing. You can enter any N by N table, where N is no larger than 20. If larger tables are needed, then the DIM statements must be changed to set up additional storage.

As a footnote to the above example, you may be interested to know that poor scheduling was the eventual undoing of Dilirius who was attacked by a frothing gladiator after the gladiator was subdued by a frustrated opossum. One could say that it certainly wasn't the boos that made him Diliruis, but it was the boos that led to his downfall. ■

Program Next Page

```
LIST
ASSIGN

10  DIM A[20,20],P[20,2],R[20],C[20],Z[40,2],X[20,20]
11  DIM W[20,20]
20  PRINT "FØR AN NXN MATRIX, INPUT THE VALUE ØF N: ";
30  INPUT N
40  PRINT "ENTER THE MATRIX ØNE RØW AT A TIME, WITH CØMMAS"
50  PRINT "SEPARATING EACH ELEMENT:"
60  MAT  INPUT X[N,N]
70  FØR I=1 TØ N
80  FØR J=1 TØ N
90  W[I,J]=X[I,J]
100 NEXT J
110 NEXT I
120 PRINT " "
130 PRINT "THE CØST MATRIX IS:"
140 PRINT " "
150 MAT  PRINT X;
160 PRINT " "
170 FØR I=1 TØ N
180 M1=9999
190 FØR J=1 TØ N
200 IF X[I,J]<M1 THEN 220
210 GØTØ 230
220 M1=X[I,J]
230 NEXT J
240 FØR J=1 TØ N
250 X[I,J]=X[I,J]-M1
260 NEXT J
270 NEXT I
280 FØR J=1 TØ N
290 M1=9999
300 FØR I=1 TØ N
310 IF X[I,J]<M1 THEN 330
320 GØTØ 340
330 M1=X[I,J]
340 NEXT I
350 FØR I=1 TØ N
360 X[I,J]=X[I,J]-M1
370 NEXT I
380 NEXT J
390 MAT A=ZER[N,2]
400 MAT C=ZER[N]
410 MAT Z=ZER
420 MAT P=ZER
430 MAT R=ZER[N]
440 L=1
450 FØR I=1 TØ N
460 J=1
470 IF J>N THEN 640
480 IF X[I,J]=0 THEN 510
490 J=J+1
500 GØTØ 470
510 IF I=1 THEN 600
520 L1=L-1
530 FØR K=1 TØ L1
540 IF (A[K,2])#J THEN 560
550 GØTØ 580
560 NEXT K
570 GØTØ 600
580 J=J+1
590 GØTØ 470
600 A[L,1]=I
610 A[L,2]=J
620 C[J]=1
630 L=L+1
640 NEXT I
650 L=L-1
660 IF L=N THEN 1600
670 M=1
680 FØR I=1 TØ N
690 J=1
700 IF J>N THEN 860
710 IF X[I,J]#0 THEN 750
720 IF C[J]#0 THEN 750
730 IF R[I]#0 THEN 750
740 GØTØ 770
750 J=J+1
760 GØTØ 700
770 P[M,1]=I
780 P[M,2]=J
790 M=M+1
800 FØR K=1 TØ L
810 IF (A[K,1])=I THEN 840
820 NEXT K
830 GØTØ 880
840 R[I]=1
850 C[A[K,2]]=0
860 NEXT I
870 GØTØ 1380
880 K2=M-1
890 R1=P[K2,1]
900 C1=P[K2,2]
910 K3=L
920 K=1
930 S=1
940 IF K=1 THEN 1110
950 GØTØ S ØF 960,1040
960 FØR J=1 TØ K3
970 IF A[J,2]=C1 THEN 1010
980 NEXT J
990 K=K-1
1000  GØTØ 1150
1010  R1=A[J,1]
1020  S=2
1030  GØTØ 1110
1040  FØR J=1 TØ K2
1050  IF P[J,1]=R1 THEN 1090
1060  NEXT J
1070  K=K-1
1080  GØTØ 1150
1090  C1=P[J,2]
1100  S=1
1110  Z[K,1]=R1
1120  Z[K,2]=C1
1130  K=K+1
1140  GØTØ 940
1150  K5=1
1160  IF K5=K THEN 1260
1170  FØR I=1 TØ L
1180  IF A[I,1]#Z[K5+1,1] THEN 1210
1190  IF A[I,2]#Z[K5+1,2] THEN 1210
1200  GØTØ 1220
1210  NEXT I
1220  A[I,1]=Z[K5,1]
1230  A[I,2]=Z[K5,2]
1240  K5=K5+2
1250  GØTØ 1160
1260  L=L+1
1270  A[L,1]=Z[K,1]
1280  A[L,2]=Z[K,2]
1290  IF L=N THEN 1600
1300  MAT P=ZER
1310  MAT R=ZER
1320  MAT C=ZER
1330  FØR I=1 TØ L
1340  C[A[I,2]]=1
1350  NEXT I
1360  M=1
1370  GØTØ 680
1380  M1=9999
1390  FØR I=1 TØ N
1400  IF R[I]#0 THEN 1470
1410  FØR J=1 TØ N
1420  IF C[J]#0 THEN 1460
1430  IF X[I,J]<M1 THEN 1450
1440  GØTØ 1460
1450  M1=X[I,J]
1460  NEXT J
1470  NEXT I
1480  FØR I=1 TØ N
1490  FØR J=1 TØ N
1500  IF R[I]#0 THEN 1540
1510  IF C[J]#0 THEN 1540
1520  X[I,J]=X[I,J]-M1
1530  GØTØ 1570
1540  IF R[I]#1 THEN 1570
1550  IF C[J]#1 THEN 1570
1560  X[I,J]=X[I,J]+M1
1570  NEXT J
1580  NEXT I
1585  PRINT "INTERMEDIATE MATRIX"
1586  MAT  PRINT X;
1590  GØTØ 680
1600  Q=0
1610  FØR I=1 TØ N
1620  Q=Q+W[A[I,1],A[I,2]]
1630  NEXT I
1640  PRINT " "
1650  PRINT "MINIMUM TØTAL CØST IS:";Q
1660  PRINT " "
1670  PRINT "THE SØLUTIØN PAIRS FØLLØW, WITH RØW
                                        INDEX FIRST:"
1680  PRINT " "
1690  MAT  PRINT A;
1700  PRINT " "
1710  PRINT "THE FINAL MATRIX FØRM FØLLØWS:"
1720  PRINT " "
1730  MAT  PRINT X;
1740  STØP
1750  END
```

```
RUN
ASSIGN

FØR AN NXN MATRIX, INPUT THE VALUE ØF N: ?4
ENTER THE MATRIX ØNE RØW AT A TIME, WITH CØMMAS
SEPARATING EACH ELEMENT:
?6,2,8,4
??5,9,4,3
??5,12,8,9
??15,30,20,18

THE CØST MATRIX IS:
 6      2      8      4
 5      9      4      3
 5      12     8      9
 15     30     20     18

INTERMEDIATE MATRIX
 4      0      3      0
 4      8      0      0
 0      7      0      2
 0      15     2      1

MINIMUM TØTAL CØST IS: 28

THE SØLUTIØN PAIRS FØLLØW, WITH RØW INDEX FIRST:
 1      2
 3      3
 4      1
 2      4

THE FINAL MATRIX FØRM FØLLØWS:
 4      0      3      0
 4      8      0      0
 0      7      0      2
 0      15     2      1

DØNE
```

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CS-1002. Number Games-1. Six number logic games including **Guess** in which you guess a secret number. **23-Matches**—try not to take the last match. **Letter** in which you guess a secret letter. **Number,** a random jackpot game. **Trap** in which you trap a mystery number between two trap numbers. **Stars** gives you stars as clues to the secret number. $7.95.

CS-1201. Sensational Simulations-1. Five super simulations including the popular **Animal** in which the computer learns animals from you. **Fur Trader** lets you trade furs in old Canada. **Hammurabi** in which you manage the city-state of Sumeria. Or try making your fortune in the **Stock Market.** A logic game, **Word,** has you guess secret words. $7.95.

CS-1003. Logic Games-2. Six challenging puzzles including **Rotate,** in which you order a matrix of random letters. **Strike-9,** try to remove all nine digits without striking out. The classic number game, **NIM.** In **Even-Wins** try to take an even number of chips. **Hi-Lo,** a number guessing game with a jackpot. **Batnum,** the super "battle of numbers!" $7.95.

CS-1004. Graphics Games-1. Five amazing realtime graphics games designed especially for your PET. In **Chase,** one player pursues the other through a maze of obstacles and "zap doors." **Escape**—attempt to escape from a prison patrolled by robot guards. **Dart** provides arithmetic drill and indicates how close your response is to the correct answer on a dart board. In **Snoopy** you compute distances on a number-line while trying to shoot down the Red Baron. In **Sweep** you must try to hit nine targets in order by controlling the path of a cannonball. $7.95.

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CS-1005. Graphics Games-2. Six favorite games. **LEM,** lunar lander with a graphic display and optional auto-pilot. **Nuclear Reaction,** a game of skill for two players. **Artillery,** in which two players shoot it out over computer-generated terrain. **Bounce** traces the path of a ball bouncing around the screen. **Checkers,** with graphic display, from our *BASIC Games* book. **Dodgem,** try to outmaneuver another player or the computer to get your pieces across the board first. $7.95.

CS-1006. Conversational Games-1. Talk to **ELIZA,** the computerized psychoanalysis program. Compose poetry with **Haiku.** Challenge your vocabulary and word-guessing skills with **Hangman. Hurkle,** try to find the hurkle on the 10 by 10 grid in five moves. In **Hexletter,** you compete to capture more letters on a hexagon than your opponent. $7.95.

CS-1007. Board Games (7 Games). Yahtzee — classic 5-dice game. Win or lose your fortune in **Blackjack.** The classic game of **Backgammon.** Defeat the Klingons with your phasers and photon torpedoes in **TREK3. One Check** — solitaire game to leave one checker on a board. **Bug** — graphic demo zaps bug. **Revenge of the Bug** — graphics demo. $7.95.

CS-1008. Sports Games-2 (7 Games). Kite Flight — cut the string of your opponents kite. **Splat** is a parachute jump game. **Car Race** — zoom around the course. **Breakout** — knock bricks off the wall. **Bowling** — a day at the lanes. **Football** — you're the quarterback. Shoot baskets in Basketball. $7.95.

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Apple II Software

CS-4001. Space Games-1. Four color-graphics programs for your Apple, including **Rocket Pilot** an advanced lunar lander simulation in which you guide your spacecraft over the mountain to a safe landing on the opposite side. In **Saucer Invasion**, you protect the earth by shooting down the alien invasion fleet with your missile launcher. In **Star Wars**, you line up the Tie fighters in your sights and fire before they get away. **Dynamic Bouncer** is a color graphics demonstration program for your Apple which fills the screen with colored walls that appear and disappear at random, while a ball bounces around within. $7.95.

CS-4002. Sports Games-1. Four exciting graphics games. Includes an amazing **Baseball** game for two players who control infielders and outfielders, type of pitch, and the swing of the bat. Even has sacrifices, double plays, and home runs. **Horse Race** allows up to eleven players to bet on the outcome of a horse race. **Slalom** challenges you to ski through the gates in a minimum time. In **Darts** you try to throw your darts as close to the bullseye as possible by controlling the game paddles. $7.95.

CS-4003. Strategy Games-1. Play **Checkers*** in color against the Apple. **Skunk** is a dice game for one or two players. **UFO** is a space game in which you must outwit an enemy spaceship. **Blockade** with exciting graphics and sound effects, with a one or two player option. **Genius,** a challenging trivia quiz. *Requires Applesoft BASIC. $7.95.

CS-4201. CAI Programs-1. US Map asks you to identify states and their capitals. **Spelling** helps the user study a list of words he has previously entered. **Math Drill** for simple arithmetic problems. **Add-With-Carry** is a sophisticated tool for teaching addition of two and three place numbers by helping the student work the problem digit by digit, adjust to the student's level of skill. $7.95.

CS-4301. Know Yourself (4 Programs). Life Expectancy — will a different life style increase your life expectancy? **Psychotherapy** — analyze symptoms in your feelings and behavior to determine your mental health. **Computer Literacy** — what's yours? **Alcohol** — effect of alcohol on your behavior. $7.95.

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CS-9001. Games-1. An 8" floppy disc containing the first **fifty-one** games from *Basic Computer Games* in Microsoft Basic. All the games from **Acey Ducey** to **Hi-Q** including such favorites as **Animal, Bullfight, Craps,** and **Hangman.** (To run this, you need CP/M and Microsoft Basic.) $17.95.

CS-9002. Games-2. The second half of Basic Computer Games including **Life, LEM, Mugwump, Stars, 23 Matches, Word,** and forty-five others. A total of **fifty-one** games on an 8" floppy disc. $17.95.

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CS-5001. Graphics Games-2. (6 Games). LEM — lunar lander with display and optional auto pilot. **Nuclear Reaction** — two players bombard an atom with protons and electrons. **Pie Lob** — two players lob pies at each other over a sand castle. **Bounce** traces the path of a bouncing ball. **Checkers** — beginners game. **Dodgem** — try to get your pieces across the board first. $7.95.

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CS-6001. Graphic Games-3 (4 Games). In **Tank Attack** seek and destroy enemy guns hidden among houses and trees before they get you. **Dodgem** — try to get your pieces across the board first. **Free for All** — airplane, ship, and submarine vie for each other. **Hidden Maze** — find your way through an invisible maze. $7.95.

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Radio Shack TRS-80 Software

CS-2001. TRS-80 4k Level I Games-1. Battling **Deathstars,** an exciting two player realtime graphics game. **Hangman** challenges you to guess the computer's word before you're hung. **Lunar Lander** in which you try to land safely on the moon. Kid's **Math Race** teaches simple arithmetic. Or play **checkers** against your TRS-80. $7.95.

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April Foolishness Dept....

Predictive Documentation By Computer

PETER J. DENNING
Purdue University

Some years ago, I read a science fiction tale in which an inventor connected a teletype to a random letter generator: as chance would have it, the machine began, after some years of producing garble, generating recognizable sentences. Soon it was engaged in printing the entire written works of man. One day, on reading newspaper texts from a future time, he destroyed the machine, sold his house, and vanished.

Yesterday's science fiction is tomorrow's science fact. Turning the scientific truth underlying this whimsical tale to reality was the objective of our Predictive Documentation Project. It is well known in mathematics that any given sequence of letters will appear as a substring infinitely often in an infinite sequence of letters. The practical problem of retrieving a substring as long as the entire written works of man is severe, for we have neither infinite stores nor infinite times in which to examine them. It is not difficult to prove that the mean distance from the beginning of an infinite string of letters until the beginning of the first substring constituting the entire written works of man is approximately 10^{27} letters, assuming that letters are generated according to their frequencies in standard English and that the Sprintworthy technique of autocorrelation is employed in the random letter generator (Sprintworthy, 1970). This result is of little practical value on ordinary computers, which can perform perhaps 10^7 operations per second. At such speeds, the computer would require 10^{20} seconds, or roughly $10^{14}/3$ years, to begin generating the entire works of man.

An important, but little noticed, technological advance was made in the late 1960's: the computer research group at the Sam Houston Institute of Technology designed an instruction-lookahead, multiply pipelined machine for weather prediction (Fern, 1969). In a configuration with P parallel pipelines and L instruction-lookahead units, the machine could perform

$$f(P,L) = 10^{9+\log_L P}$$

operations per second. In its maximum configuration with $P = 1000$ and $L = 10$, $\log_L P = 3$ and $f(P,L) = 10^{12}$ operations per second. At this speed, the above computation time is reduced from $10^{14}/3$ to $10^9/3$ years. The machine, therefore, does not meet our research need.

For us, the breakthrough came in 1971 when one of the members of our research team, Foonman, discovered an ingenious way of folding the pipeline mechanism back on itself through the lookahead units (Foonman, 1972). The technique, which is the subject of a patent application, is based on dividing the P pipelines into L groups; by feeding the outputs of each group through a lookahead unit cyclically into the next group, Foonman was able to multiply the operation count by a large factor. Foonman's theory predicts that the modified machine's speed is f[f(P/L,L), L] operations per second. For the maximum configuration, $P = 1000$ and $L = 10$, and

$$\begin{aligned} f[\, f(1000/10, 10), 10] &= f(\, 10^{9+\log 10^{100}}, 10) \\ &= f(\, 10^{11}, 10) \\ &= 10^{9+\log_{10} 10^{11}} \\ &= 10^{20} \text{ operations per second.} \end{aligned}$$

The modified machine is thus capable of performing about 3×10^{26} operations per year; the time for it to reach the first substring containing the entire written works of man is thus a little over 3 years.

The machine, with Foonman's modification, was put into operation in January 1974. In mid February 1977, as expected, the first written sentences of man began appearing on the output device. The Old Testament started appearing on March 13, and the New Testament on March 28. These documents were handed over to the Department of Ancient Scriptology of this university, where they may help unravel the mystery of the Dead Sea Scrolls.

Although the machine is busily producing the entire written works of man, it is (to our surprise) not producing documents in their natural historical order. Shortly after the New Testament was printed, for example, we discovered the text of the April 15, 1977, issue of the *New York Times.* (Thereafter, Chaucer's *Canterbury Tales* began appearing.) This proved to be a blessing in disguise, for we did quite well in the stock market on April 15 and were able to finance the project for two additional years.

To no one's surprise, much of the machine's output is of little interest — for the entire written works of man include diaries of unknown people, or old grocery lists. The mean

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time between the production of major documents appears to be one to three weeks. When produced, these documents are sent to the appropriate university department or government agency for study.

The implications of this machine for text editing are enormous, as it is now possible to get the final version of a document without having actually to prepare it. This article, for example, has not yet been written. We found it in the machine's output for 30 April 1979.

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3. Foonman, J.J., "A device for multiplying the operation count on a folded highly parallel machine for solving weather prediction problems," Report No. TR-72-99 (1972); patent application 077-555-1212.

Manuscript written 30 April 1979; received 10 April 1977.

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Puzzles & Problems

Greetings, puzzle fans, my name is Charles Barry Townsend and I am your new puzzle editor. To help me with this column I have enlisted the help of an old magician friend of mine, Merlin of King Arthur's court. Together we have written several books chronicling the best puzzles that have perplexed and bemused thinking people for over one hundred years. Besides presenting, what we consider to be, some of the classic problems of the past we cordially invite all of our readers to send in their favorite puzzles. the writer of each puzzle that Merlin selects for inclusion in this column will receive a free copy of the book "Merlin's Puzzler 2".

So much for introductions. Let's get down to puzzling, Merlin, if you please!

An Enigma

A headless man had a letter to write,
It was read by a man who had lost his sight.
The dumb repeated it word for word,
And deaf was he who listened and heard.

Merlin has started the ball rolling with a difficult problem. (Hint: There's more than one way to write a letter).

A Tale of Greed

Two Bedouin Arabs halted in the desert to eat their midday meal. Their store consisted of eight small loaves, of which five belonged to the first and three to the second. Just as they sat down, a third Arab overtook them and asked to be permitted to share their meal, to which they agreed. Each ate an equal portion of the eight loaves, and the third Arab, at the close of the meal, handed the others eight pieces of money in payment. A dispute arose as to the division of the money, the first Arab maintaining that as he had five loaves and the other three only, the money should be divided in the same proportion. The other maintained that as all had eaten equally, each should take half the money between them. Finally, they agreed to refer the matter to the third Arab, who declared that both were in the wrong, and pointed out the proper division. What was it?

Alice in Puzzleland

"Well, Alice, my dear," said the Duchess, "put down that croquet mallet and give me your attention. You will need more than five minutes to solve my puzzle. Framed below we have a portion of the alphabet. Some of the letters are above the line and some are below the line. You are to write the remaining letters, placing them correctly either above or below the line. I will meet you at the Palace when you have finished."

A EF HI KLMN	
BCD G J	OP

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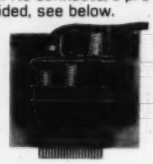

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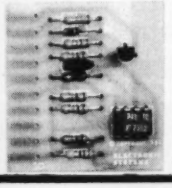

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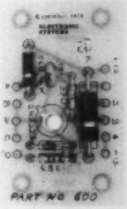

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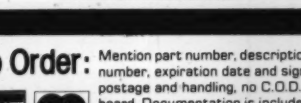

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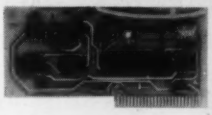

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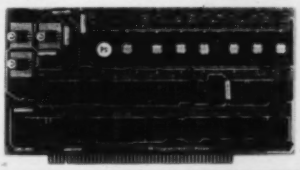

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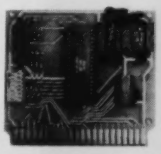

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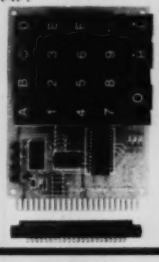

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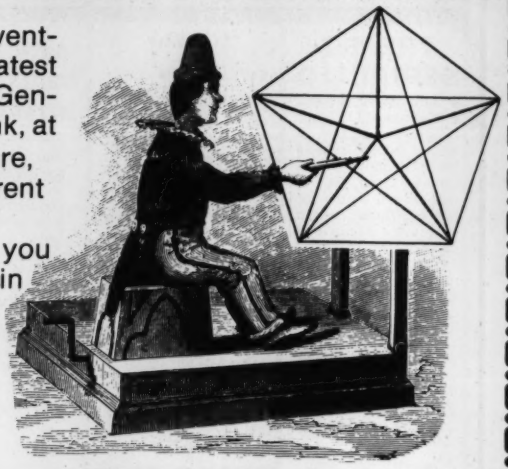
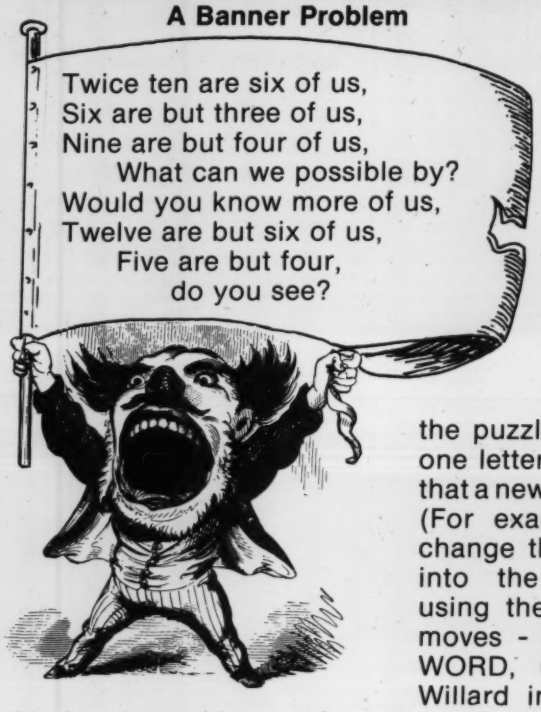
CIRCLE 174 ON READER SERVICE CARD

Professor Pepper, at the last puzzle convention on Merlin's Isle, exhibited his latest invention, The Automation Puzzle Generator. All you have to do is turn the crank, at the base of the generator, and the figure, dressed like a clown, will draw a different puzzle for you every time. The puzzle generated in our picture is simple enough, all you have to do is calculate the number of triangles in the "star" drawing. Be careful, though, you are allowed only one try at it.



The Puzzle Generator

A Banner Problem


Twice ten are six of us,
Six are but three of us,
Nine are but four of us,
What can we possible by?
Would you know more of us,
Twelve are but six of us,
Five are but four,
do you see?

The Old Soup and Fish

Willard Wordsworth, the "Word Professor" has a change-the-word puzzle that could have come straight out of a P.G. Wodehouse novel about "Jeeves" and Bertie Wooster. The expression "putting on the Old Soup-and Fish" is used here to tax your puzzling powers. Willard explains that in this type of puzzle the object is to change the word in the top row into the word in the bottom row in the least amount of moves. During each move the puzzler must change one letter in the word so that a new word is formed. (For example: You can change the word WARM into the world COLD using the following four moves - WARM, WARD, WORD, CORD COLD). Willard informs me that this is a very old type of puzzle, and, a very entertaining type in that it is not to difficult for the reader to make up similar puzzles on his own. (If you come up with any good ones send them along to Merlin).

S	O	U	P
F	I	S	H

A Weighty Matter

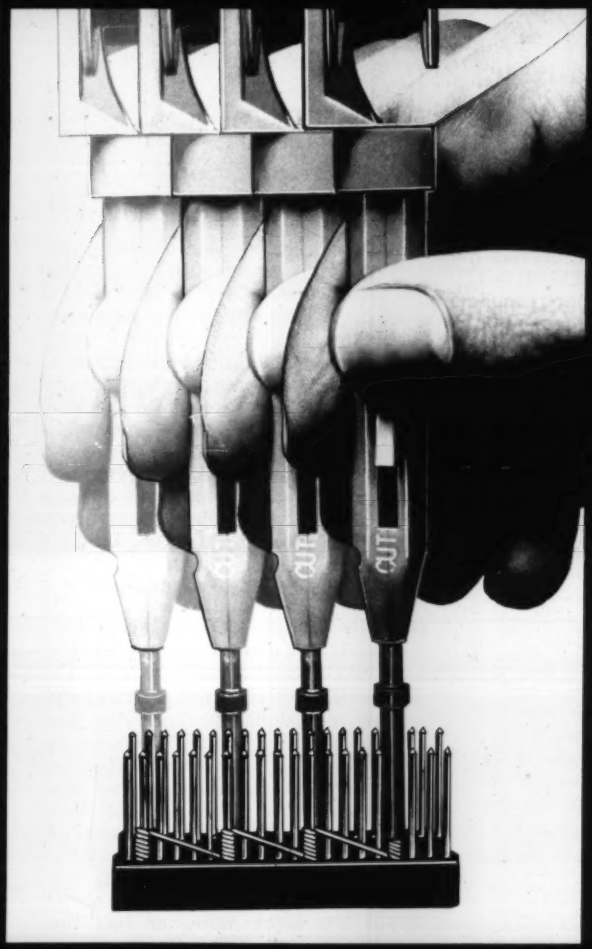
With how many weights, and of what denominations respectively, can you weigh any number of pounds from 1 to 127 inclusive?

Well, that's it for this issue, folks. By the way of introduction Merlin challenged you with seven puzzles from our books "Merlin's Puzzler 1 & 2". Next month we will venture farther afield.

Your Editor

Answers on page 152.

NEW!



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WHY STRIP?
WHY SLIT?

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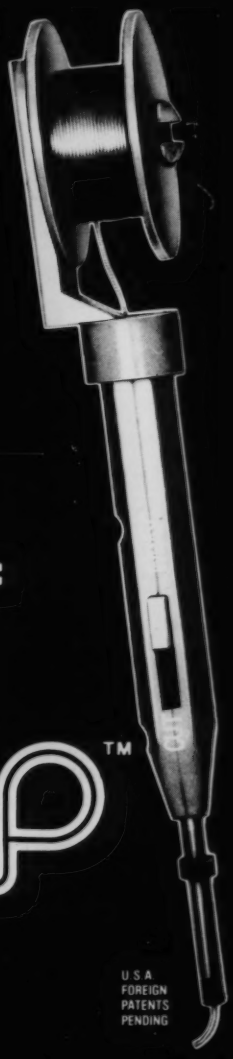

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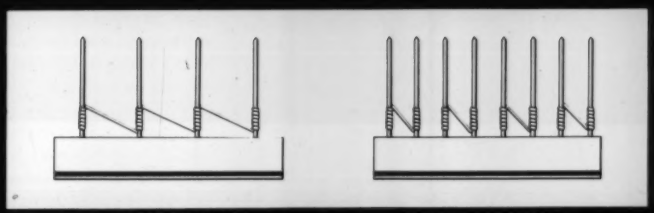
RED	R-JW-R	2.98



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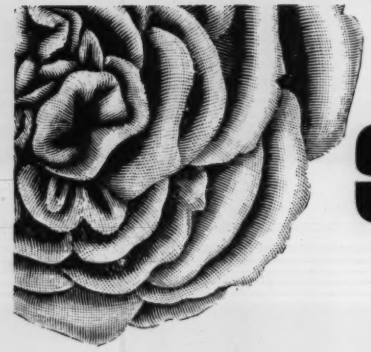
CIRCLE 188 ON READER SERVICE CARD



SUPEROSE

Michael D. Zorn

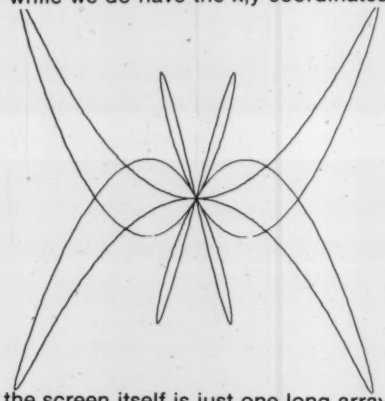
I was inspired by the article "Gumowski," in the Sept/Oct *Creative Computing*, to find a similar routine for my new PET. The limiting factor of a 25 by 40 display precludes anything approaching the subtle tracery produced by that remarkable program. This routine, however, has several advantages (besides that of running on a PET!): it is easily adaptable to any BASIC computer driving a character or high-resolution display — such as the TRS-80, the Apple, the new Exidy and all the rest. It can be used with a line printer (though storage space and time will be a consideration here), and if you have an x-y plotter, you're really in luck, because you can generate the figures in their greatest detail. The accompanying figures show examples of line printer output, on a 40 by 70 grid, and x-y plotter output.

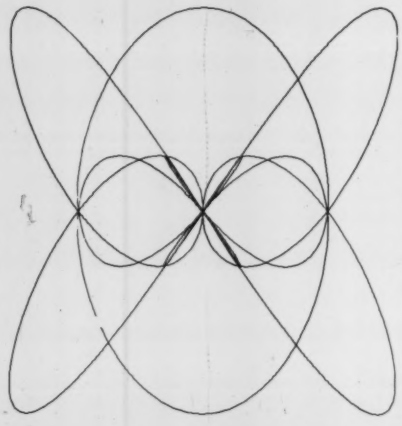
HOW IT WORKS

The routine itself is quite simple, yet provides a great deal of flexibility. The essence of the algorithm is in line 107. Think of a pen mounted on a rotating arm of varying length. Let the radius change as a function of the angle, and the pen will trace out a curved line. In particular, if R doesn't change at all, we have a circle centered on the pivot of the arm. Line 107, then, defines the function, in this case, R = Z*SIN(TH*T). Line 100 lets the arm go once around a circle (to 2π radians) in increments of two degrees.

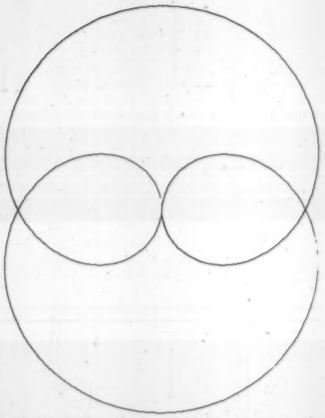
That's all there is to it. However, unless you're writing to a radar screen, you need to get from the land of (r,theta) to the land of (x,y). This is done by the next two lines: 110 and 115. In the PET, X% and Y% automatically convert the results to integer. Be sure not to omit this conversion — it's an essential part of the process.

We're still not there, though, because while we do have the x,y coordinates,





the screen itself is just one long array (1000 bytes in the PET, for example). Line 120 takes care of this problem. (Notice the similarity to the routine in the Short Programs section in that same issue.) Let's take the transformation in two steps: first, consider the screen as a 40 by 25 grid, with the point (1,1) at the lower left. The upper left, or home, would be (1,25), and the upper right, (40,25). So we can find the location of (x,y) in the screen array by P = (25 - y)*40 + x. Since we'd like the origin to be in the center of the screen, all we need to do is translate the origin from the lower left, 20 units right and 13 units up: P = (25-(y+13))*40+(x+20). This formula then reduces to line 120

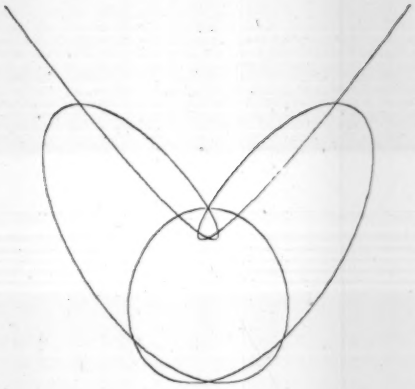


(actually, the sign of Y is reversed, but all that does is invert the figures, and I like them better that way).

CONVERTING TO OTHER SYSTEMS

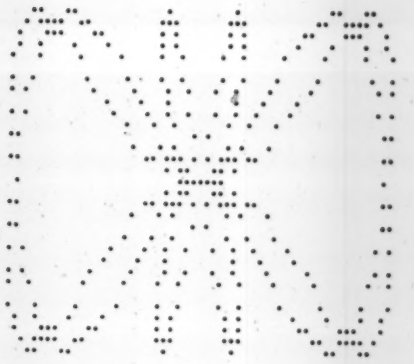
Now let's consider modifying the routine for your particular computer. In line 120, the 40 represents the number of characters or points across the display, and the 20 is just half that number. The 12 is half the number of lines — each "half" truncated to integer. The Z in line 37 sets the maximum radius, and should be set to about the same value as half the number of lines. If Z is too large, the figure will extend past the edges of the screen. The K in line 38 allows for the screen aspect ratio. It insures that a circle comes out circular, rather than elliptical. For the PET, 1.25 seems to work quite nicely. To calculate the value for your particular system, first plot (or print) a column of 10 symbols. Then find out (by marking the length on a card) how many symbols across it takes to make the same length. Then K = number across/number down. The Q = 81 tells which character is POKEd onto the screen. For the PET, this is the big dot, shift-Q. Asterisks seem to work nicely on a printer. For higher resolution displays, you might prefer points. The S in line 39 is the location of the start of the screen in memory.

Michael D. Zorn, 833 S. Peck Rd. #4, Monrovia, CA 91016



THE ANT

For a line printer, the setup is a little different. In this case, we start with an M by N array of blanks. As each X,Y is generated, set ARRAY (X,Y) to DOT. Then, when the figure is completed, print the entire array at one time. To figure the size of the array, start with the numbers of lines on a page — let's suppose it's 40, as in my case. Multiply this by the printer's aspect ratio. Most printers I've seen are 10/6. This gives 66.6666, which we round up to the next convenient round number — say, 70. Then dimension the array 40 by 70, and proceed as before. If the 70 is larger than the number of print positions on your printer, start with that number and work backwards.

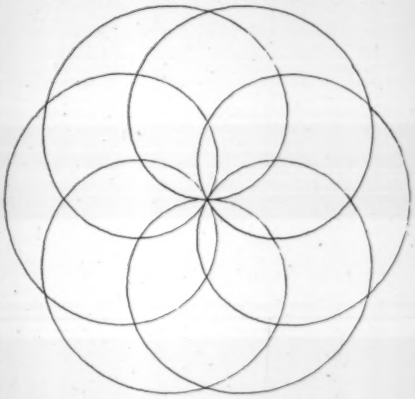


THE BUTTERFLY

For a plotter, take out the integer conversion, replace line 120 with the equivalent of CALL PLOT(X,Y) (that is, move the pen to the next x,y), and set Z according to the plotter's specifications. If the figure is too granular, decrease the step size in line 100, to 1 or even .5.

CHECKOUT

To check out the routine for a non-PET system, first put a REM into line 107 to hold the radius constant, and input A=1 and B=1. This should generate a circle of maximum radius. (You might want to take out the integer conversion at lines 110 and 115 at this point to see what happens.) If that works, you're home free. Take out the REM, input A=1 and B=1, and you should see the 3-leaf rose. If the circle is too big, however, reduce Z. If the circle isn't circular, adjust the value of K. If the dots seem randomly sprinkled over the screen, check out line 120. Copy it into another line, say 5000, followed by a PRINT,P. Then feed it x=0,y=0, and P should be at the center of the screen (500 for the PET). Feed it the coordinates of the corners, and see if they map correctly into the screen array. The upper left coordinate (-19,12 for the PET) should give 0 or 1.

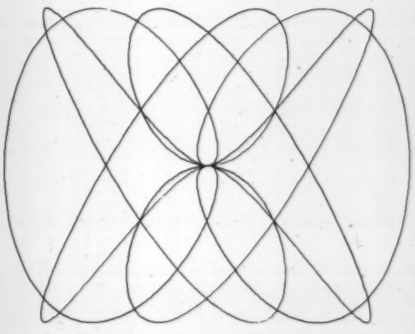


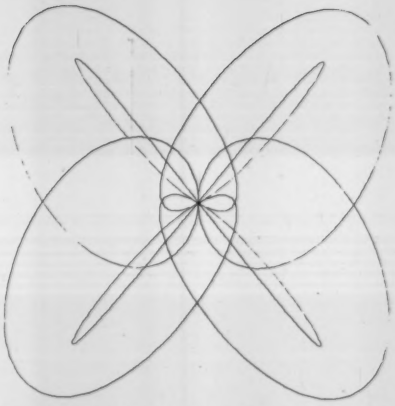
THE LOTUS

For a plotter, make sure that the pen starts out at the middle of the page. Also, make sure that the pen doesn't come down until the first (x,y) is reached (it may not always be at the origin). Finally, make sure that the value for Z gives a maximum size circle during the initial checkout.

APPLICATIONS

The fundamental shape for a given value of T is drawn when A=B=1. In general, when T is odd, there are T leaves (use them later to have your fortune told) and when T is even, there are 2T leaves. Then let A and B vary as integers in the range 1 through 10 or so to produce the variations on the





fundamental shape. Some of the figures are quite striking, and deserve to be given names, such as the Glider (A=1,B=5), the Ant (4,5), the Butterfly (1,6), and the Lotus (4,4). All of these are for T=3, as are the figures on these pages. After you've gone through these few hundred possibilities, here are some directions for opening up the investigation:

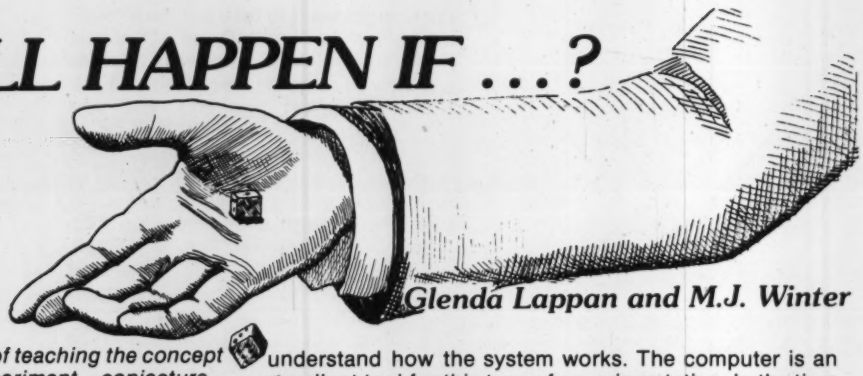
- let A and B be non-integers
- holding A constant, produce a series of figures by slowly varying B in fractional steps from one integer to the next
- let T be a non-integer (interesting values for A, B, and T would be numbers of the form p/q, where p and q are small integers)
- use the X and Y values to drive a digital-to-analog converter which in turn drives an oscilloscope
- run the routine in a "warp drive" mode by setting A=B= a very large number (between 30000 and 100000)

All of this has come from the simple formula r = a sin n. There are any number of other formulas you might use. The only restriction is that r should not be allowed to grow without limit, as would be the case with r = a tan. If you do use a formula like that, be sure to check the limits on X and Y, or you'll be POKEing into the operating system, into your hi-fi set, and into the PET next door.

There's an almost infinite variability to these figures, yet they're not random — they're symmetrical, mathematical, and beautiful.

```
 37  Z=12 : Q=81
 38  K=1.25
 39  S=32767
 40  T=3
 41  INPUT "A<B";A,B : PRINT "§"
100 FOR TH=0 TO 2*π STEP 2*π/180
107     R=Z*SIN(TH*T)
110     X% =K*R*COS(A*TH)
115     Y% =R*SIN(B*TH)
120     P=(12+Y%)*40+X%+20
130     POKE S+P,Q
140 NEXT TH
150 END
```

WHAT WILL HAPPEN IF ...?



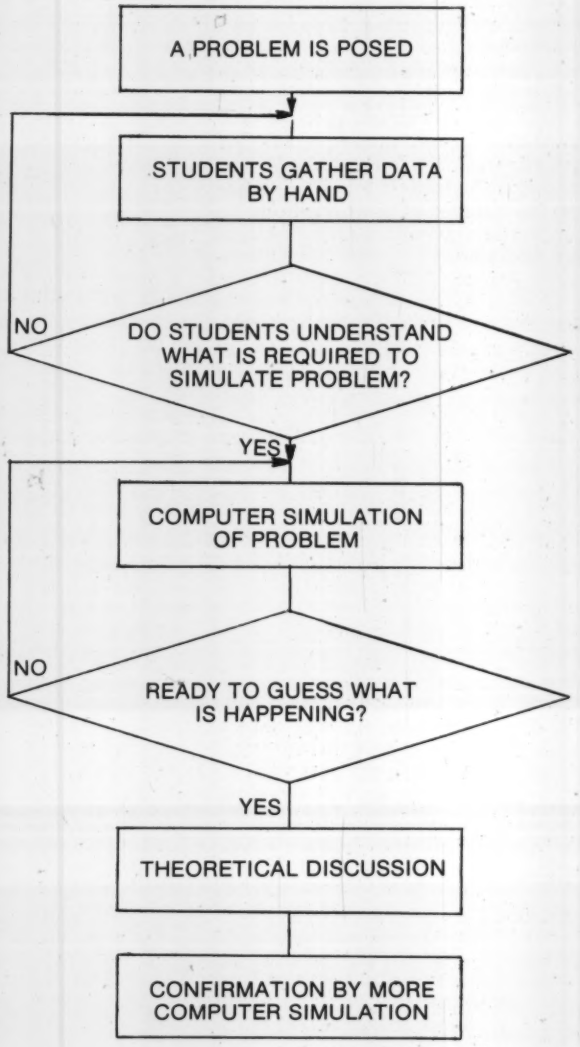
Glenda Lappan and M.J. Winter

This article describes a method of teaching the concept of expected value through an experiment - conjecture - explain mode which uses the computer to simulate repetitions of games. The games, the rationale for choosing those particular games, and the computer programs to simulate the games are given in detail.

WHAT WILL HAPPEN IF...?

In the 1600's a French gambler, the Chevalier de Mere, had a run of "bad luck". The dice turned against him and he suddenly found himself in the uncomfortable position of losing money! For some time the Chevalier had been systematically winning by betting (at even odds) that in four tosses of a die he would obtain a six at least once. When his source of takers dried up, he changed the bet. He now bet that in 24 tosses of a pair of dice, he would obtain a double-six at least once. Since 4/6 = 24/36, he assumed he had an equally profitable bet. To his surprise he began to lose. In his search to find out why, he consulted Blaise Pascal (1623-1662) who in turn discussed the problem with Pierre de Fermat (1601-1665), two of the greatest mathematicians of all time. From the analysis of de Mere's problem a new branch of mathematics was born. Born of a desire to understand the behavior of systems that cannot be entirely controlled.

Just as the Chevalier started his study of probability with a misunderstanding about the probabilistic basis of his new bet, many students start their study of probability with misconceptions about the nature of a probabilistic statement. Their prior study of mathematics has dealt (at least in their minds) with exact answers. Students expect probability to deliver an exact description of what will happen. If a fair coin is tossed 10 times you will get exactly 5 heads. Consequently, (the students' reasoning goes) if you have tossed it 9 times and have gotten h,t,h,h,t,h,t,h,t, then of course the next toss has a high probability of being a t. If you ask a class on day one which outcome is more likely to happen (h,h,h,h,h,h,h,h,h,h) or (h,t,t,h,h,t,h,h,t,t), many of the students will choose the latter because 5 t's and 5 h's are more likely than 10 t's. True, but not relevant to the question asked. Each of the outcomes has probability $1/2^{10} = 1/1024$ of happening. Let us give another example from a game situation. If the probability of winning a game which pays even money is 3/7, the student expects to be exactly $1 behind at the end of 7 games. The student assumes that you win exactly 3 and lose 4. So you win $3 and lose $4, for a total loss of $1. Theoretically he is correct. It is in the belief that this theoretical expected value determines what will happen for each 7 games that the student is in error. The authors feel that students need to have their "faith" in what probabilistic statements mean shaken. To accomplish this, students need to do a great deal of experimentation before being exposed to a theoretical discussion of certain aspects of probability. That is, they need to explore a situation until they have some feeling for what is happening or until, as de Mere, they are puzzled enough to understand how the system works. The computer is an excellent tool for this type of experimentation. In the time it takes students to repeat an experiment 100 times, a computer may simulate the experiment 10,000 times. The thinking required to set up a computer simulation is in itself useful in understanding the experiment. A useful sequence of activities for students might look like this:



Paper first delivered at AEDS Convention, May 16-19, 1978, Atlanta, GA.

The rest of this paper describes a sequence of laboratory and hands-on computer activities designed to assist in the teaching and learning of one important aspect of the probability of game situations — expected value. These activities are divided into two groups.

The first group comprises several games of "chance". The games, with names such as Gambler's Choice, Over and Under, Coins in a Pocket, have been programmed in BASIC, using the RND function. The outcomes depend on a roll of dice, a random sample, or a coin toss. Students play the games several times, as many as they think necessary in order to predict the result if each game were to be played 10,000 times. The games are designed so that for some, a prediction can easily be made, for others, not. A classroom discussion of expected value enables the students to verify the accuracy of some of their predictions. Extended discussion of the expected value of independent variables leads to successful analysis of the remaining games.

The second group develops intuitively the expected number of trials until first success, preparing the way for a classroom derivation of the formula 1/p. Simulation of completing a collection of baseball cards allows the students to compare a complicated example with the results predicted by theory.

ACTIVITIES

The unit is introduced by simulating **COINS IN A POCKET.** The story is that a newspaper costs 5¢. A customer has 5 pennies and a dime in his pocket and offers to pay for the paper by letting you, the vendor, select, at random, 2 of the 6 coins. Using marked chips, the students repeat the selection of coins 10 times and calculate the total value of the coins selected. One student might obtain 2 pennies 8 times and a dime and penny 2 times for a total of 38¢. Based on these 10 trials, the student would predict that after 100 trials she would have $3.80; in other words the average of 3.8¢ per trial would hold.

To actually repeat the game 100 times would be time-consuming, so we look for a way to do it by computer. On our machines, Tektronix 4051's, using BASIC, RND (-1) produces a random variable between 0 and 1, (the (-1) ensures that repetitions will produce different results). 6*RND(-1) lies between 0 and 6; so that X = INT(6*RND (-1)) produces a variable equally likely to take on the values 0,1,2,3,4,5. We identify selecting a coin with generating X; if X = 0 we'll say we selected the dime. The program we use is:

```
100 PRINT "TAKING TWO COINS AT RANDOM FROM A
    DIME AND 5 PENNIES"
110 PRINT
120 PRINT "HOW MANY TIMES SHALL WE REPEAT?"
130 INPUT N
140 U=O
150 FOR K=1 TO N
160 X=INT(6*RND(-1))
170 IF X=O THEN 220
180 Y=INT(5*RND(-1))
190 IF Y=O THEN 220
200 U=U+2
210 GO TO 240
220 U=U+11
240 NEXT K
250 PRINT "AVERAGE VALUE OF THE TWO COINS IS
    ";U/N;" CENTS"
260 END
```

Running this program for N = 100 leads most students to predict that after 1000 times the total amount would be close to 5000 cents. Coins in a Pocket is a good game situation to start with because the average value becomes apparent after a few runs of 100 trials. In the next sequence of games it is much harder to decide on the average value.

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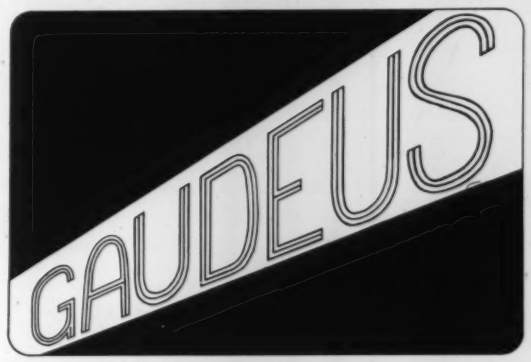

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CIRCLE 153 ON READER SERVICE CARD

GAMBLER'S CHOICE: A gambler has a choice of two games. The first costs $10 to play; 3 dice are rolled and the player receives the sum of the numbers rolled in dollars. The second game costs $12 to play; 2 dice are rolled and the player receives the product of the numbers rolled in dollars. The program plays both games the same number of times.

```
100 PRINT "GAMBLERS CHOICE"
110 PRINT
120 PRINT "GAME 1 COSTS $10 TO PLAY. 3 DICE ARE
    ROLLED."
130 PRINT "YOU GET THE NUMBER OF DOLLARS
    EQUAL TO THE SUM OF THE DICE"
140 PRINT
150 PRINT "GAME 2 COSTS $12 TO PLAY. TWO DICE
    ARE ROLLED. YOU GET THE"
160 PRINT "NUMBER OF DOLLARS EQUAL TO THE
    PRODUCT OF THE DICE"
170 PRINT
180 PRINT "HOW MANY TIMES DO YOU WANT TO PLAY
    EACH GAME?"
190 INPUT N
200 I=0
210 J=0
220 FOR K=1 TO N
230 X=INT(6*RND(-1))+1
240 Y=INT(6*RND(-1))+1
250 Z=INT(6*RND(-1))+1
260 I=I+X+Y+Z-10
270 J=J+X*Y-12
280 NEXT K
290 PRINT "IN GAME 1 YOUR WINNINGS TOTAL ";I;"
    AVERAGE PER GAME=";I/N
300 PRINT
310 PRINT "IN GAME 2 YOUR WINNINGS TOTAL ";J;"
    AVERAGE PER GAME =";J/N
320 END
```

Typical outputs are:

AVERAGE WINNINGS PER GAME

N	*Game 1*	*Game 2*
1000	.58	.41
1000	.45	.20
5000	.54	.35

For the game one the students might say, "There appears to be an average value and it appears to be in the low 50's." For game two the data presents a much more confusing picture.

OVER AND UNDER: This game has been popular at fundraising events. Two dice are rolled; the player can bet that the sum of the numbers showing will be under 7, equal to 7, or over 7. Bets on over and under each pay even money; 7 pays four times the bet. If you always bet over (or under) what will your winnings be after 100 games? After 10,000 games? Will you do better if you always bet on 7? (Losing less *is*, mathematically, doing better!) For a series of 100 games, the outcome is clear, but the amount of the average loss is not clear.

```
100 DIM W(3)
110 PRINT "OVER AND UNDER"
120 PRINT "HOW MANY GAMES DO YOU WANT TO
    PLAY?"
130 INPUT N
140 PRINT "HOW DO YOU BET? FOR UNDER, ENTER
    -1; FOR 7 EXACTLY, ENTER 0;"
150 PRINT "FOR OVER, ENTER 1"
160 INPUT B
170 W(1)=O
171 W(2)=O
173 W(3)=O
180 FOR J=1 TO N
190 C=INT(6*RND(-1))+1
200 D=INT(6*RND(-1))+1
210 IF C+D  7 THEN 250
220 IF C+D=7 THEN 270
230 W(3)=W(3)+1
240 GO TO 300
250 W(1)=W(1)+1
260 GO TO 300
270 W(2)=W(2)+1
300 NEXT J
310 IF B=-1 THEN 360
320 IF B=O THEN 390
330 G=W(3)-W(2)-W(1)
340 GO TO 430
360 G=W(1)-W(2)-W(3)
370 GO TO 430
390 G=4*W(2)-W(1)-W(3)
430 PRINT "YOUR TOTAL WINNINGS ARE $";G
440 PRINT "AVERAGE WINNINGS PER GAME ARE
    $";G/N
450 END
```

BETTING ON 7		*BETTING ON OVER*	
Number of Games	*Average Winnings*	*Number of Games*	*Average Winnings*
100	-.25	100	-.22
100	-.35	100	-.20
100	-.20	100	-.08
100	0	100	-.12
100	-.5	100	-.20

After the students have played these games and have tried to predict the outcome for 10,000 or 100,000 trials, we emphasize that their predictions are made on the basis of average winnings and then consider the following situation: Let 2 coins be tossed. If they both show heads, you will win $5. If one is heads and one tails, you will win $2, but if they both show tails, you will lose $20. Suppose the game has been played 1000 times with the outcomes:

Heads, Heads 200 times
Heads, Tails 721 times
Tails, Tails 79 times

Your winnings will be

$$\text{winnings} = 5 \times 200 + 2 \times 721 + (-20) \times 79$$

Your average winnings per game will be

$$\text{average winnings} = \frac{\text{winnings}}{1000} =$$

$$5\times[\frac{200}{1000}] + 2\times[\frac{721}{100}] + (-20)\times[\frac{79}{1000}] = .862.$$

The bracketed terms, $[\frac{200}{1000}]$, $[\frac{721}{1000}]$ and $[\frac{79}{1000}]$ are the relative frequences of 2 Heads, Heads and Tails, and 2 Tails, respectively. Over a great number of trials, these relative frequencies will approach the theoretical probabilities of these events. When the relative frequencies are replaced by probabilities, we call the average winnings, the expected value of the game.*

Expected Value = E = payoff x probability + payoff x probability + ...

Now we will look at the games played and compute theoretical expected values. For coins in a pocket, the probability of 2 pennies is $\frac{10}{15}$ the probability of a dime and penny is $\frac{5}{15}$. Thus the expected value is

$$2\times\frac{10}{15} + 1\times\frac{5}{15} = \frac{75}{15} = 5 \text{ cents.}$$

This confirms the student predictions based on the simulations.

For Over and Under, the probability of a 7 is 6/36 = 1/6; the probability of over is 15/36; the probability of under is also 15/36. For the games, assuming a $1 bet,

$$E(\text{bet on 7}) = 4 \times 1/6 + (-1) \times 5/6 = -1/6$$
$$= -.1666$$
$$E(\text{bet on over}) = 1 \times (15/36) + (-1) \times (21/36)$$
$$= -1/6 = -.1666$$

The student predictions based on the simulations cited earlier might be -.26 for a bet on 7 and -.16 for a bet on under. After the theoretical discussion, the students might decide to simulate the experiment again using the computer for a larger number of trials.

For Gambler's Choice I and II, the possible outcomes can be listed and their relative frequencies (i.e. theoretical probabilities) can be determined. For example in Game 1, we get the following theoretical frequencies

Sum	3	4	5	6	7	8	9	10	11	12	13
Frequency	1	3	6	10	15	21	25	27	27	25	21

14	15	16	17	18
15	10	6	3	1

$$E(\text{game 1}) = (-7)\times(\frac{1}{216}) + (-6)\times(\frac{3}{216}) + (-5)\times(\frac{6}{216}) + (-4)\times(\frac{10}{216}) + (-3)\times(\frac{15}{216}) \ldots \text{etc.}$$

E (game 1) = .50

These calculations are tedious and serve as a motivation for the theoretical analysis of expected value of independent events. If X,Y and Z are the values showing on a die, then E(X + Y + Z) = E(Y) + E(Z) and E(XY) = E(X)E(Y). The expected value on the face of a die is $\frac{1+2+3+4+5+6}{6} = 3.5$. For game 1, subtracting the $10 to play, the expected value is 3.5 + 3.5 + 3.5 - 10 = .5 or $.50. For game 2 it is (3.5) x (3.5) - 12 = 12.25 - 12 = .25. From the simulations, the former value was predicted by many students; the .25 did not become apparent even after 10,000 trials.

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CIRCLE 119 ON READER SERVICE CARD

TRIALS UNTIL FIRST SUCCESS

One of the first applications of expected value is determining the mean number of trials until first success. The students first use the computer to simulate several examples. The program used is:

```
LIST
100 PRINT "NUMBER OF TRIALS UNTIL FIRST
    SUCCESS"
110 PRINT "ENTER P, THE PROBABILITY OF
    SUCCESS, AS A DECIMAL"
120 INPUT P
130 PRINT "ENTER N, THE NUMBER OF
    EXPERIMENTS"
140 INPUT N
150 T=O
160 FOR J=1 TO N
170 K=O
180 X=RND(-1)
190 K=K+1
200 IF X < P THEN 220
210 GO TO 180
220 T=T+K
230 NEXT J
240 PRINT "AVERAGE NUMBER OF TRIALS UNTIL
    SUCCESS IS ";T/N
250 END
```

Then if p is the probability of success and q = 1 – p the probability of failure, the expected number of trials is

$$E = 1 \cdot p + 2q \cdot p + 3q^2 \cdot p + 4q^3 \cdot p + \ldots,$$

where $1 \cdot p$ stands for 1 trial x probability of success, $2 \cdot q \cdot p$ stands for 2 trials x probability of 1 failure then success, $3 \cdot q^2 \cdot p$ stands for 3 trials x probability of 2 failures then success. A standard manipulation, computing E – qE, summing the geometric series and solving for E, leads to

$$E = \frac{1}{1-q} = \frac{1}{p}$$

If the probability of success is 1/6, e.g., as in rolling a 4, then it will take on the average 1/p = 6 tries until the first success, i.e., until the first 4.

BASEBALL CARDS: An application of this result is the number of baseball cards needed before acquiring a complete set. We assume there is an unlimited supply of N different baseball cards. The expected number of cards necessary to have a complete set is

$$\frac{N}{N} + \frac{N}{N-1} + \frac{N}{N-2} + \cdots + \frac{N}{1} = N\left(1 + \frac{1}{2} + \frac{1}{3} + \cdots + \frac{1}{N}\right).$$

For N = 10, E = 29.29. For N = 50, E = 224.96. The program listing is

```
100 DIM C(100)
110 PRINT "BASEBALL CARDS. THERE ARE N CARDS
    IN THE SERIES. ENTER N"
120 INPUT N
130 PRINT "FROM HOW MANY TRIALS DO YOU WANT
    TO COMPUTE THE AVERAGE?"
140 INPUT K
150 S=O
160 FOR I=1 TO K
170 D=O
180 FOR J=1 TO N
190 C(J)=O
200 NEXT J
210 X=INT(N*RND(-1))+1
220 C(X)=C(X)+1
230 IF C(X)=1 THEN 250
240 GO TO 210
250 D=D+1
260 IF D=N THEN 280
270 GO TO 210
280 T=O
290 FOR J=1 TO N
300 T=T+C(J)
310 NEXT J
320 PRINT T;" CARDS"
330 S=S+T
340 NEXT I
350 PRINT "AVERAGE NUMBER OF CARDS IS ";S/K
360 END
```

Sample output from the BASEBALL CARDS program is:

```
BASEBALL CARDS. THERE ARE N CARDS IN THE
SERIES. ENTER N
10
FROM HOW MANY TRIALS DO YOU WANT TO COM-
PUTE THE AVERAGE?
15
  29 CARDS
  31 CARDS
  34 CARDS
  17 CARDS
  64 CARDS
  44 CARDS
  20 CARDS
  30 CARDS
  23 CARDS
  38 CARDS
  30 CARDS
  16 CARDS
  31 CARDS
  23 CARDS
  28 CARDS
AVERAGE NUMBER OF CARDS IS 30.5333333333
```

Let us return to the Chevalier de Mere's problem and compute the expected winnings of a bet of a louis d'or in each situation.

The probability of at least one six in four rolls of a fair die is $1-(5/6)^4 = .5177$, so that the expected winnings are:

$$E=1 \times .5177 + (-1) \times .4823 = .0354.$$

But, the probability of a double six in twenty four rolls of a pair of fair dice is

$$1 - \left(\frac{35}{36}\right)^{24} = .4914$$

so that the expected winnings are

$$E=1 \times .4194 + (-1) \times .5086 = -.0172$$

Computer simulations make one wonder how much time the Chevalier spent gambling since the difference in the two bets is not perceivable in 10,000 trials!

*For this example,

$$E = 5 \times \left(\frac{1}{4}\right) + 2 \times \left(\frac{1}{2}\right) + (-20) \times \left(\frac{1}{4}\right)$$

$$= -\frac{11}{4} = -3.75$$

In the (very) long run you will average a loss of $2.75 per game. ■

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CIRCLE 170 ON READER SERVICE CARD

I Can Steal Your Computer!

Dr. Harold Gluck

Don't be fooled if this article has an air of "fiction" to it. The author is a police criminologist, carries a gold police shield, is Dean of the American Academy of Criminology and is a "first rate (legal) burglar."

When it comes to stealing your personal computer I am the best in the field. I was just a small timer when one of the biggest fences out here sends for me.

"I got a setup for you that will make you rich," he tells me. "From now on you only rob homes where they have a personal computer and I will tell you who has them. All you have to do is to steal it. You have to deliver to me eight to ten a week at the least. You get one hundred bucks for each job. What do you say?"

This looked like big money to me. So I went to work stealing computers. Maybe I will hit you soon. I'm not dumb, and I soon figured out he was paying for the tips on which people had those computers. That's his business, not mine. And I know he turned them over to a big outfit.

My girl goes with me and sits at the wheel of my car. I am going to burglarize the third house on the left in this small community. I have already phoned and got no answer. Just as a double check, I was on the line for ten minutes in case somebody was in the shower. The door in front of this house is made of heavy wood and has two locks. However, there is a back door. The kids go in and out of it and the neighbors often use it in their calling. It is made of light wood and has six small glass panels. Got such a door in your suburban home? I knock out one panel completely, put my hand through and turn the inside latch. I enter quickly. If I want to play it double-safe, I have ready another pane of glass that I can shove into place. But I know beforehand just where that computer is located—in the studio room on the first floor. In less than three minutes flat, I am out of the house and the computer goes into the truck of my car.

Dr. Harold Gluck, 2939 Grand Concourse, Bronx, NY 10468.

You should know that the best time for me to hit a private home is on weekdays, between 10:30 A.M. and noon or between 1:30 P.M. and 3 P.M. Housewives, their husbands at work and their children in school, are apt to be away during those hours.

I do some casing prior to hitting a private home. My girl friend has a walkie-talkie so she can communicate with me. Just in case danger appears we've got a set of code words.

"Looks like clouds on the horizon," means a couple is headed my way. "I think Pete is here," means a patrol car is approaching. "There's a gathering for the picnic," ... a group of kids is headed my way.

Twenty minutes from the place I robbed, in another community, is a big expensive home. This fellow has a real expensive personal computer in his den, down in the basement. I watched him come home. He has that nice efficient "wireless door raiser" for his garage. He didn't come out so I figured (correctly, it turned out) that he has a door from the inside of his garage to the rest of his house.

I rented a car just like his, so if somebody spots it they would think he came home early. And despite what the manufacturer might tell you, I know how to raise that garage door. The door from the inside of the garage to the rest of the home was open. I got a bonus for this job.

I used a trick you've probably never heard of to rob a college prof of his personal computer. I found out that he and his wife lived there alone. So what did I do? I bought them two orchestra seats for a leading show and I sent them to the husband with a note like this: "Dear Professor—Just to repay the favor you did for me. Hope you and the wife enjoy the show." Then I signed with an initial that he couldn't read. Not only did I get that computer, but he had some cash laying on his open desk!

In one home I hit, there was an expensive painting on the wall. But I make it a rule: Never have any stolen merchandise in my home. If there is cash around for the taking, I take it.

Some of the older homes in the suburbs have ground-level windows to give air and light to the basement. All I have to do in those cases is kick in the glass, reach in and open the window. There is usually an outside garbage can in the back of the house so I can conceal the broken glass. I don't bother to replace it in these situations.

Sure, I can pick locks. I don't like the front-entry job as a rule, but I have used it with this technique: I carry a large wrapped box as though I'm a delivery man. I know the people are out. I ring the bell and then pick the lock. I took that computer out by the back door.

One fellow had a setup that beat me. No trouble getting into his house. In the studio room there was a heavy iron stand. Which was actually bolted to the floor. The computer was bolted to this stand. As I looked at it, I had a funny feeling go down the back of my spine: A hundred to one he's got a special hidden burglar alarm that will go off if I try to rip the setup apart. So he kept it and I guess he never knew I visited him.

Two weeks later I made up for that one. My fence sends for me and gives me an address. "This fellow has nine computers upstairs in his home. He gives special evening classes. He's got top hardware on his doors and windows and a burglar alarm system that goes to an answering service. Can you handle it? I'll get you two extra people if you need them."

Nothing doing on the extras. If they get caught they can put the finger on me. So this is how I got those nine computers:

I rented a panel truck. On the side I attached removable signs: "Roof repairs." My girl put on jeans. She is going to work with me on this one. I know when the owner is out. His wife works in the college. I go around the back. Put a ladder up against the wall. I go up to the second floor. He's got no protection against a burglar there. Open the window easily. I used a rope and a large canvas coverbag. Down gently went those computers. No damage at all to them. However, I was worried in case somebody spotted me. It worked out fine.

Now some advice (for free) on how you people who live in private homes, and have computers, can protect them. There may be no such thing as a burglar-proof home. But there is a home that will resist burglars. The burglar must work against time. If he comes to the back door and sees it's not glass but steel, and he finds a garage door to the house that is really secure, he may be discouraged. On front and back doors, have two good bolt locks with top cylinders. Protect the cylinder with a face plate. Otherwise, it can be pulled out! You can also have metal strips along the door so it is tough to try to pry it open. And no hinges from the outside! I still laugh about the back door I removed with a simple screwdriver.

Put locks on all windows, and that includes your upstairs windows. You can get a vibration detector or metal stripping that will sound an alarm if somebody tries to break the glass.

But remember: Somebody has to hear the alarm and be ready to go into action. Forget the visible outside alarm that I can put out of commission easily. It should be connected to an alarm service company. One community has a TV surveillance setup directly to police headquarters. I won't hit that place.

For you folks who live in apartment houses and have those nice personal computers keep in mind that I stay away from those that have an alert doorman. He has to check on me with the occupant and he can easily remember me again.

So I go for the apartment house without a doorman. My fence gives me ten names and addresses of people that live in apartment houses and have personal computers. Some apartments still are without those intercoms. Even those with them present no problem. First I use the phone trick. Then I double check with the intercom. No answer, and I do have a set of pass keys on me. I open the door and go up to apartment 5C.

This fellow has two locks on his door. I got a crowbar underneath my jacket. I force the door open! You see, the frame rests on wood and is old. Once inside the rest is easy.

I don't like fire escapes, but I have tried that method. To protect yourself, get a strong metal window guard. Be sure it is one approved by the fire department. Now here is something you wouldn't think about unless I told you about it: Also protect the windows on the side of the fire escape! With care I can get to that ledge and open the window!

Ever hear about the police I.D. service? They lend you an engraver. With it you inscribe your social security number on the frame of your personal computer. You can buy a cheap engraver for under twenty dollars. It is a good investment.

I am starting to wonder: What happens if my fence can't get those leads any more? So I tried something to see how it would work. I got an outfit that makes me look like a man from the phone company. With lots of tools around me. I go to some houses in a small suburban town near a big university. I visit eight homes. No trouble at all! This is what I say at the door: "Phone company. There's a hum along the line. Just a few minutes to check it out." I even had a card with my picture on it made up by a friend. If they want my I.D., I hold it up. Of those eight homes, there were computers in three of them! A month later I got all three.

I tried a different trick in some apartment houses. Had a can with me. "Exterminator man, madam," is what I said. I was welcomed and used the can. But I looked around quickly. Of seven I visited, only one had a pesonal computer. Better business for me if my fence keeps on getting those leads.

Finally, ideas for you people living in private homes or in apartments. Trust nobody at the front door! Every I.D. can be forged. Have a wide angle peep hole so you can look out. If you see what looks like an I.D. card you ask for the name of the agency, person in charge and address. If you get a phone number, don't call it! It could be to a pal in the bar. Check with information. Of course you can tell that person outside: "I have just called the police. Hope you don't mind waiting until the patrol car arrives."

I know, it's a helluva world with all of us wanting to knock you over. Be careful and alert and know the game ... and keep your computer. ■

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PEOPLE PROGRAMMING

James W. Garson

How about making allowances for operator errors ... and even correcting them? Here are some ways to do it along with an introduction to parsing.

If a computer is going to understand any language other than machine code, it will have to contain a *parser,* a program that figures out what expressions of the language mean by decomposing them into their parts. Both interpreters and compilers spend most of their time parsing the lines of a program. In most cases, parsers are written using *stacks* and a few simple programming tricks. Stack parsing is an elegant and flexible tool, which has a wide variety of uses. In this article we will explain how it works and show how it can be used to make life easier for people who use computers.

To illustrate the main ideas involved, we will present a simple program, called a *people parser,* that evaluates expressions of arithmetic like (2+3)*4, 8/4-2 and 2*3)-4. The first of these, (2+3)*4, is relatively straightforward; it stands for 2 plus 3 (=6) times 4 (=24). The second, 8/4-2, might lead to confusion because it is not clear whether we are to divide 8 by 4 (=2) and take 2 from this (=0), or to subtract 2 from 4 *first* (=2) and then divide 8 by this (=4). Most *people* would assume (unless their brains are warped by too much APL) that the *division* should happen first, and the correct result is 0. In ordinary life, we assume that division and multiplication are to be done before subtraction and addition unless parentheses say otherwise. As we will see, it is a very simple matter to build this "hierarchy" of the operators into a stack parser.

You might think that the last expression, 2*3)-4, was a misprint because of the missing left parentheses. But one of the points of this paper (maybe its main point) is that using a stack parser it is easy to evaluate expressions in spite of parentheses errors.

Parentheses errors are annoying bugs. Not only are they more frequent than we would care to admit, but they are the kind of error the computer ought to fix. I mean, if the parser is smart enough to figure out that your parentheses are mismatched, then it ought to be smart enough to figure out how to fix them. "Hmmm..." you say, "Sounds like a dream. Wouldn't it take a big expensive program to fix the errors in an intelligent way?" The answer is "No!" It takes virtually no extra code to write a stack parser that is kind about parentheses.

So why don't people do this already? They do, sometimes, but generally systems programmers think that it is better to abort at a parentheses error because there is no assurance that the computer will fix things up correctly. Agreed, even the most intelligent parser is not going to be able to guess what the programmer intended in all cases. But there is a tradeoff to be weighed here. It is not clear that the cost of a bad guess by the computer outweighs the penalty of having a program that won't run because the system was hung up about a silly parentheses error. The vast majority of parentheses errors are easy to fix. The expression 2*3)-4 for example, clearly means multiply 2 and 3 and subtract 4, and as we shall see, this is exactly what our people parser will make of it. Once you see how well a people parser does at correcting errors, you will be a lot less worried about misinterpretation by the computer. Besides we could always tell users what correction is being made so they can confirm or reject the computer's decision.

As more and more real people (as distinguished from programmers) get the chance to interact with computers, it becomes more important to be gentle about mistakes that are made at the terminal. I became interested in this because of my work on EMIL, a system to help people learn how to find proofs in logic. To use it, people must type in logic formulas. Parentheses errors are quite common, especially at first, but the parser in EMIL does not complain, since it can fix them with a high degree of accuracy. This avoids a lot of frustration

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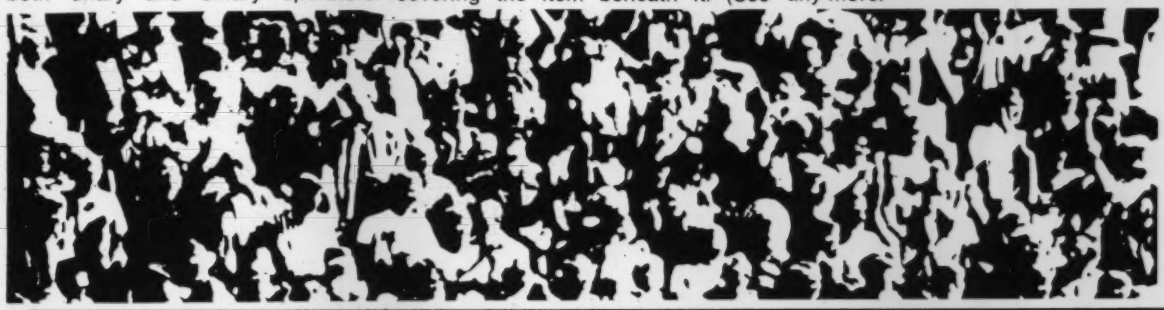
in interacting with the computer. I have enjoyed the tolerance EMIL shows so much that I wonder whether people, and even programmers, wouldn't be happier with gentle parsers.

Since it is easiest to work with an example, we will build a people parser for expressions of arithmetic which involve numbers, +, –, *, /, and parentheses. To keep the illustration simple, we will assume that we already have subroutines that can detect and evaluate the numbers and can perform addition, subtraction, multiplication and division. We will also assume at first that + and – are always *binary* operators, that is, that they have to be flanked by *two* numbers. Ordinarily we write –5 as shorthand for 0–5. In –5, – is a *unary* operator, because it is applied to *one* number, not two. In arithmetic notation, same symbol – is used for both unary and binary operators. Once we have a parser for binary operators, we will explain how to handle unary ones, and also how to deal with symbols like – that are both binary and unary.

The first thing we have to do is explain what a *stack* is. Stacks are basic programming tools which have a variety number of applications. If you know about stacks, just skip this paragraph. A stack is very much like what its name implies, it is just an ordered pile of items (think of a stack of pancakes). One of the items is at the top of the stack and it is the only one that is accessible. (If you try to get a pancake in the middle the whole stack is liable to topple over.) There are two basic things you can do to a stack: *push* (or add) a new item on the top of the stack, covering the item that used to be on the top, or *pop* (or remove) the top item from the stack, uncovering the item beneath it. (See Figure 1.)

Most programming languages don't have stacks, but it is easy to simulate them using arrays. Let's start with a one dimensional array called STACK; the items on our stack are stored in STACK (1), STACK (2), STACK (3), ... etc. We also need a variable called TOP which contains the number of the position in STACK where the item at the top of the stack is found. So STACK(TOP) is the item at the top of the stack. To push a new item on the stack, you simply let TOP=TOP+1 and then set STACK(TOP) = ITEM. To pop the stack and put the popped item in RESULT, just let RESULT=STACK (TOP) and TOP=TOP–1. (You might want to erase the item in STACK(TOP) before setting TOP=TOP–1, but usually this isn't necessary.) If we pop a stack enough times it will be empty, i.e., TOP will be 0 and we cannot pop it any more.



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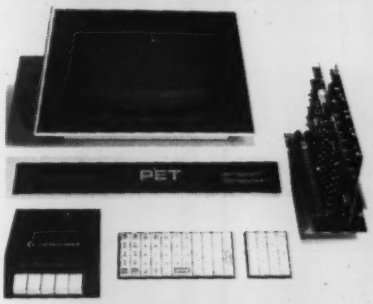

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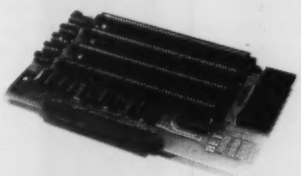

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Our people parser will contain two stacks. The first, called *number stack* will contain values of numbers that we find, and *operator stack* will contain operators +, –, *; /, and also). Each of the stacks will have a separate variable that says where the top is. Now apart from the usual processes of popping and pushing stacks we will want to explain another one called *plop*. Plop is a sort of glorified pop that applies to both of our stacks. To plop the stacks you: 1) pop a symbol off the operator stack, 2) pop the top *two* numbers off the numberstack, and then 3) apply the subroutine for the operator you got to the numbers you got. Then 4) you push the result back on the number stack. For example, if 3 and 2 are the top two numbers on the number stack and + is on the top of the operator stack, then the result of plop will be to pop + off the operator stack, pop off 3 and 2, and then put the result of adding 3 and 2 (namely 5) back on the number stack. (see Figure 2.) If we ever find) on the operator stack and are asked to plop the stacks we simply pop it off and leave it at that, for it doesn't correspond to any mathematical operation.

Since we are going to let our parser determine grouping on the basis of the hierarchy of the operators, we will need a table of strengths of the symbols we will be using

Symbol	*Strength*	
/	4	
*	3	Table
–	2	of
+	1	Strengths
)	0	

We included the symbol) on the table with strength 0 for convenience. The reason for this will be clear later.

Now we know enough to learn how our people parser works. It is a bit easier, though not necessary, if our parser reads expressions from the right to the left, instead of in the usual way. (This allows an easier solution to the problem of adding unary operators.) Now here's what to do. We consider each symbol of the input expression in turn starting from the right. If it is) it is pushed on the operator stack. If it is a number, its value is pushed on the number stack. If it is (you keep plopping the stacks until either) is at the top of the operator stack, (or that stack is empty). If it is a binary operator, (like + or *) then we plop the operator stack repeatedly (if we have to) until the operator being scanned is stronger than what is on the top of the operator stack. (See the table of strengths.) Then we push the symbol on the operator stack and start the process over from the top.

When you have finished scanning the expression you simply plop the stacks until the operator stack is empty. Lo and behold, the value of your expression will be on the top of the number stack and that stack will contain a single item.

There are some details about the process which we have not been explicit about in this description. Since you may want a handy chart for checking what the people parser does to sample expressions we have written out the program in Figure 3. It should be fairly easy to read. We use 'do while' followed by a condition, so that the statements which go with it are simply skipped if the condition is not met. For example in:

3. Do while (is scanned:
   3A _____
   3B _____
   3C _____

5.

statements 3A-3C are performed repeatedly as long as (is being scanned, but if (is not scanned we go to line 5. We use indention and outline notation to indicate which statements go with which 'do while.'

To help those who are used to BASIC understand the do while construction, here is how we would write

```
30 Do while ( is scanned:
31 _____
32 _____
50 Do while a binary operator is
     scanned:
```

in BASIC:

```
29 REM S$ CONTAINS THE SYM-
     BOL CURRENTLY BEING
     SCANNED
30 [IF S$ < > ( THEN 50]
31 _____
32 _____
33 GOTO 30
50 [If S$ < > + & S$ < > * &
     S$ < > - & S$ < > / THEN 60]
```

The best way to understand this whole thing is to go through an example or two. So let's see what happens when we parse 8/4-2. Starting from the right we see 2. This goes on the number stack. Then we see – which goes on the operator stack, since the stack is empty. Next, we put 4 on the numberstack and then we come to /. Since – is on the top of the operator stack, and / is stronger, we push / on that stack. Finally we come to 8 which goes on the number stack. Our two stacks now look like this:

Number stack	Operator stack
8	
4	/
2	–

We have finished scanning our expression so we have to plop until the operator stack is empty. After the first plop we have:

Number stack	Operator stack
2	
2	–

and after the second:

Number stack	Operator stack
0	–

We are done, and the right value (namely 0) appears on the number stack.

Now let's see how our parser works on 2+3*4. Since * is stronger than +, we will want the multiplication evaluated first so that the expression comes to 14. Let's see if that is what we get. First, 4 goes on the number stack, * on the operator stack and 3 on the number stack. Our stacks look like this:

3	
4	*

Now we find + and since this is weaker than * we have to plop the stacks.

12	

Now our operator stack is empty and so we can push + on it.

12	+

Next we find 2, which goes on the number stack

2	
12	+

and after we PLOP the stacks to finish up, the right answer 14 appears at the top of the number stack.

Now let's just add a parentheses to the expression we just did to illustrate what happens when there is a parentheses error. Let's start with 2+3)*4. Notice that this time we should add *first* and then multiply. The result should be 20 not 14 as in the previous example and that is what happens. First we put 4 on the number stack, then * and) on the operator stack.

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The instructions say) is always pushed on the operator stack despite its strength.) Then 3 is put on the number stack. We are now scanning + and the stacks look like this:

3	)
4	*

Now + is stronger than) (which has a strength of 0), so + goes on the operator stack:

	+
3	)
4	*

Notice how) on the top of the stack protects us from seeing the *. If * were at the top, we would not be able to add + to the operator stack but would have to plop beforehand.

Next we put 2 on the operator stack and we begin plopping the stacks. After the first plop we have:

5	)
4	*

When we plop next we simply remove) from the operator stack, and at the next plop we get the right answer:

20

Let's take an expression with a mismatched left parentheses as our final example: 2*(3+4. Notice that we want to do addition first and then *, and the answer should be 14. By the time we are scanning (the stacks look like this:

3	
4	+

When we see (we are supposed to plop until the operator stack has) at the top or is empty. So we must plop once:

7

Next we see * which goes on the operator stack, and 2 which goes on the number stack:

2	
7	*

and when we finish off by plopping we get 14.

Now what do we do if we have a unary operator or two? For example, we might use ABS for the absolute value of a number. Then ABS (2-4) would stand for 2. It is very simple to modify our parser to include this. Between steps 3 and 4 we add:

4. Do while a unary operator is scanned:
   4A. Apply the function for that operator to the number on the top of the number stack
   4B. Replace the top of the number stack with the result
   4C. Scan the next symbol to the left.

For an example, let's evaluate 2-ABS(2-4). By the time we come to ABS our stacks look like this:

-2

Then we are instructed to take the absolute value of what is on the number stack and put the result back there:

2

and by the time we have scanned all the symbols we have:

2	
2	-

which results in the end with 0.

How do we manage in a notation where the same symbol can be both binary and unary? Won't we need an elaborate routine to determine whether a given symbol is to be interpreted one way or the other? Not really. We haven't discussed an important detail about the operation of plop. What happens if we try to pop the number stack and we don't have two numbers to pop? We could just stop with an error and that is probably what we will want to do in most parsers. However, in this case we can supply the value 0 for the missing number if there is one number and the operator being scanned is + or -. This has the effect of reading -5 as if it were 0-5. If we do this, we can treat + and - properly without having to decide whether they are binary or unary operators ahead of time. Assuming we make this change to plop, we need to make one slight adjustment to section 5 of our program. This section ends with 5D: Go to step 1. If you put "If you are scanning (, +, -, * or / then go to step 3, else go to step 1" instead, the program will work fine.

Let's evaluate 4+(-5*2) to see that all is well. By the time we get to -, the stacks look like this:

5	*
2	)

Since - is weaker than * we plop, and then add - to the operator stack

10	-

Next, we scan left, encounter (, which according to our revised instructions means that we go to step 3. Step 3 says it is time to plop the stacks. Since one number is missing, we supply 0; the result of subtracting 10 from 0 is 1-10 which goes on the number stack in place of 10, and the operator stack is popped.

-10

(Notice that if we hadn't changed our instructions in step 5, that we would arrive at step 2 scanning (and stop with an error.) We now scan left, and see + and then 4 with this result:

4	
-10	+

When we plop according to step 7, we get -6, which is what we want.

If the computer is going to fix up mistakes it would be best if we inform users about what changes were made by the computer, so that they can verify them. So we will need a way to keep track of what corrections were made and to assemble the corrected expression for their inspection.

This is easy to do if we take advantage of the structure we have already laid down. All we need to do is to add a new stack called the *expression stack.* This will behave very much like our number stack but it will store the corrected expression. Any time we push a number on the number stack, we push the symbol being scanned in the expression stack as well. When we plop the stacks we also modify the expression stack. We pop off the top two items on the expression stack (call them L and R), we pop the top item from the operator stack (call it 0), and then push the expression (&L&O&R&) back on the expression stack. Here we used the symbol & for concatenation, so for example if 5 and 3 are the top two items on the expression stack and + is on the top of the operator stack, then (5+3) is on the top of the expression stack after plop.

Let's watch all three of these stacks during the parsing of the expression 2*(3+4 to see how this works out. By the time we are scanning the (, the stacks look like this:

3		3
4	+	4
Number stack	Operator stack	Expression Stack

Now we plop:

7		(3+4)

Next we see * and then 2, so our stacks now look like this:

2		2
7	*	(3+4)

After plopping we have:

14		(2*(3+4))

and the result on the expression stack is the correctly parenthesesed version of our input. If you want, the outside parentheses can be stripped off so that 2*(3+4) is shown to the user.

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There are quite a number of interesting uses for this kind of parser. For example, it is a very effective structure to use for changing from standard notation (sample 2*(3+4)) to the RPN notation used by some calculators (sample 34+2*). Here you would use an expression stack and no number stack, and change plop so that O&L&R is pushed back on the expression stack instead of (&L&O&R&). It is just as easy to build a parser to convert from RPN notation back to standard notation.

If you ever get to use a people parser you will probably pick up the habit of leaving out parentheses, especially those that begin and end an expression. There is really no reason to include matching parentheses in most circumstances. For example, 2*(3+(4/7 is a *better* notation than 2*(3+(4/7)): It requires fewer symbols, expresses grouping in a way that is easy on the eye, and doesn't force us to count parentheses. In this, it has some advantages of RPN and the familiarity and legibility of standard notation. Sometimes I wonder why this kind of notation wasn't adopted in the first place. ■

FIG 3

Scan the symbols of the input expression from *right to left*. If there are no more symbols to scan, go to step 7.

1. Do while) is scanned:
   - 1A. Push) on the operator stack
   - 1B. Scan the symbol to the left
2. If you are scanning a number put its value on the number stack and scan the symbol to the left else you have an error, so stop.
3. Do while (is scanned:
   - 3A. Do while the operator stack is neither empty nor has) on its top.
     3A1.Plop the stacks.
   - 3B. If) is on the top of the operator stack, pop it off.
   - 3C. Scan the next symbol to the left
5. If a binary operator is scanned then do this:
   - 5A. Do while strength of the symbol scanned is not greater than the strength of what is on the operator stack: Plop the stacks
   - 5B. Push the symbol scanned on the operator stack
   - 5C. Scan the symbol to the left
   - 5D. Go to step 1
6. Stop you have an error
7. Do while the operator stack is not empty: Plop the stacks

FIG 1

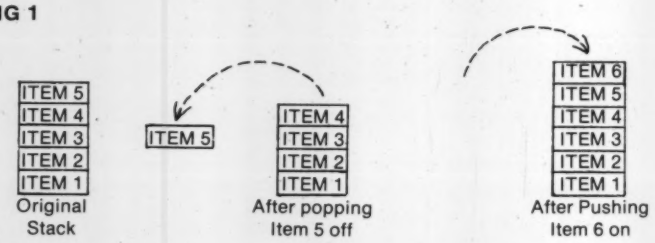
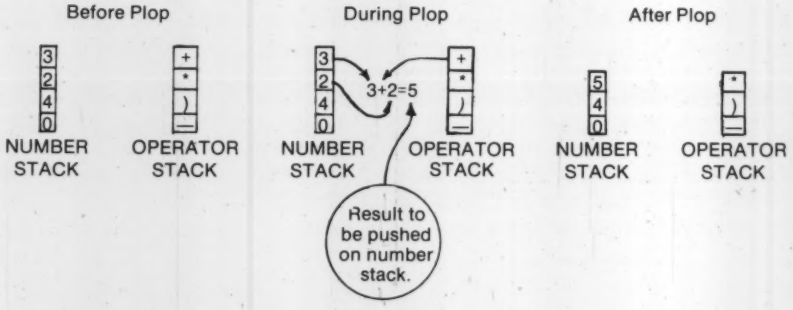


FIG 2



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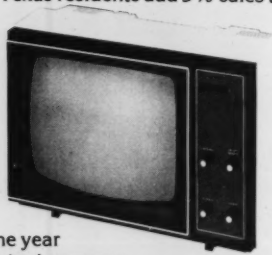

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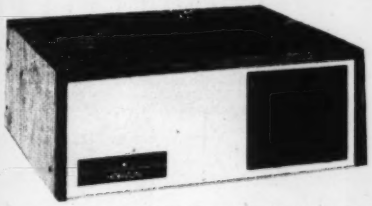

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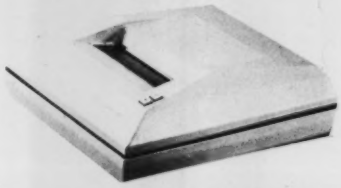

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CIRCLE 176 ON READER SERVICE CARD

The Marin Computer Center: A "New Age" Learning Environment

David and Annie Fox

There should be more "computer awareness" centers like this all over the country. Getting people, of all ages, turned on to computers and alleviating their fears should be a common goal for all of us.

Marin Computer Center is a non-profit, educational organization, whose purpose is to bring the wonders of advanced technology (computers and the like) within the reach of all people.

We have set up 16 microcomputers in what was formerly the library of a modern school in San Rafael, California. In a spacious, well-lit room, with beamed ceiling, orange carpeting and many plants, we've created the kind of comfortable environment that has rarely been associated with computers.

We would like to tell you how MCC came to be, what it is, and where we plan to take it.

How It All Began

Marin Computer Center was seen as a vision at first. We came upon the idea—or it found us—quite unexpectedly in mid-August of 1976. How strange it seems now, and yet very natural all at the same time.

To say that computers and the world they represented was far from the world that we inhabited then would be a gross understatement. At that time in our lives, and for several years prior to that time, we were "spiritualists"—lovers of the occult, psychic realm-followers of numerous "personal growth" excursions—always seeking. We considered ourselves very much the "humanists"—with our respective careers of teaching and counseling.

We felt that not enough people were coming in contact with new ideas about themselves, not enough people were growing in their personal lives. The question was, how to introduce the vast majority of Americans to themselves. We took a look around and noticed the beginning boom of video games. What if we developed a video game in which people could learn more about themselves and their relationships with others in the process of playing? Of course, the stated purpose of the game wouldn't be personal growth, that would just be a side effect of playing it.

From this idea we jumped to a fantasy of a huge complex similar to Disneyland. The main difference would be in the participation level of the visitors. Disneyland is fun but it is essentially a place where they "do it to you." You watch animated dolls while riding on a boat or go for a submarine ride and watch sea serpents looming at you. No one is given an opportunity to interact with the environment, to play with the environment in a way where some new and unique learning experience would result. We envisioned a technology playland where all this could happen. To actually "be" on the bridge of the USS Enterprise with other visitors and make contact with other worlds. To warp your own intergalactic vessel around the universe while looking through a three dimensional viewscreen and experiencing the force of acceleration. To feel weightlessness in a zero gravity room. The movies "Westworld" and "Futureworld" are the closest we've seen to this idea. Of

David and Annie Fox, Co-Directors of Marin Computer Center, 70 Skyview Terrace, Room 301, San Rafael, CA 94903.

course, the conflicts of man versus machine in those films represent the fears we wanted to help people overcome in order to make the most of technology.

With our long range goals set, we had to find something which we could accomplish with today's technology. The concept of the Marin Computer Center was born. We embarked—whole-heartedly without a backward glance. It seemed as if we had been running full steam in one direction—then one day screeched to a halt for no apparent reason—and zoomed off at twice the velocity down a new road!

It may seem strange that two people with no technical background would be audacious enough to enter the hallowed grounds of "computerland," but somehow our naivete has served to make the whole thing unique and appealing in the eyes of others.

We created Marin Computer Center because we felt that there needed to be some educational facility that would bridge the gap between people's fears and their natural curiosity about computers. It seemed evident to us that the rapid growth of the personal computing industry would result in a "computer in every home" by the early 1980's. Judging that as an inevitability and evaluating the prevailing attitude about computers, it seemed obvious that people needed a painless way to ease themselves into the Computer Age.

Many people feel that computers are cold, dehumanizing instruments of totalitarianism. The image of Big Brother and the "Computerized Society" seem to go hand in hand. At least that has conveniently been the fictionalized view. We would be the first to admit that in the recent past computers have been used in ways that have resulted in general feelings of powerlessness and dehumanization. However, it is important to distinguish between computers (the species) and how they've been used. In other words, it is short-sighted to condemn a device simply because of the misuse and abuse it has suffered at the hands of people with something less than the "common good" in mind.

Alarmists and political paranoids argue that computers are potentially dangerous in that they can be used to store incredible amounts of very personal data and then recall that information at an astonishing rate. They become uneasy at the thought of the "Master Computer" controlled by the CIA.

The Computer is a powerful tool. And it, like many powerful tools throughout history, has been used and misused by people who seek power for purposes of both good and evil.

When the printing press was first invented, the church began to fear its use for the purpose of widespread propaganda against Church Doctrine. They launched their own campaign against the machine, condemning it as a tool of the Devil. One would have to admit that there have been some pretty libelous, degrading and socially unredeeming things that have been presented to millions of people in the form of the printed word. However, one would not be hard pressed to think of just a few of the beautiful, inspiring, and beneficial things we have experienced through our exposure to words in print.

So which is it? Tool of the Devil or Invention of Enlightenment? Actually the printing press is neither. The printing press is just a machine that prints words on paper. The discussion is arbitrary and meaningless. The same is true of the debate about the potential joys and evils of a computerized society.

Computers are here to stay. And the general public needs to start taking responsibility for its own personal participation in the world of computers. Because they are such "all purpose" machines, it is up to us to decide which of their various purposes are ones that we want to support.

Marin Computer Center's main goal is to "introduce people of all ages to computers and the advanced technology which they represent in order that anyone might begin participating in the process of computer assistance for society."

When we started we felt certain that our objectives were valid and would serve a valuable function in this society. However, lofty goals and innovative plans are meaningless if they cannot be manifested in the physical universe. And in order for our dream to take real form we needed money.

Our quest for capital led us to dozens of private foundations. We spent six months peddling our grant proposals with no success to speak of.

For long periods of time our goal seemed extremely distant and as likely as a winning sweepstake ticket. In the face of such overwhelming odds and dispair, were we discouraged? We sure were! Weeks went by and nothing happened—no forward movement; our plan was stagnating and so were we. Many times it seemed as if we continued with our phone calls and letters just to spite all the people who thought we were crazy to persist with an idea that couldn't get off the ground. And I'm sure we must have been. Crazy enough to continue persisting even though the Foundations weren't exactly beating a path to our door, we knew it didn't mean that money couldn't be obtained through another source.

So we did what most people do when

they need money—we hit the banks. Lo and behold, with the help of a friend (with more financial credibility than we had) our loan application was approved!

That was in July of 1977—a full eleven months after the whole idea was hatched!

In the two months that followed, we rented 5,000 square feet in a beautiful vacated school building, ordered and received nine Sol-20's and one Equinox, obtained some programs, invited 300 people to an open house, placed three ads in local newspapers—and held our breath.

Visiting the Center

On September 10th we opened our doors—at long last Marin Computer Center had crossed over into the physical universe. Over 700 people showed up for our open house celebration and during the past year, they have steadily continued to come. Little children with their parents, neighborhood kids stopping in after school, handicapped children and adults, older people—all with an interest in computers to guide them.

MCC was created to give people an experience of computers and the advanced technology which they represent. In the first year that we've had our doors open, we have in fact been providing that kind of experience in addition to many other kinds of experiences that we had not anticipated.

For example, on Saturdays MCC provides a place for families to come together in an attractive and calm environment for a unique "learning experience." We see them come in, wide-eyed and slightly apprehensive. They have heard about this place from friends (who had "a terrific time") so they thought they'd see for themselves. They don't have any idea what to expect and frankly, they've got their guard up. We greet them and make them feel welcome. We acknowledge the uncertainty they are exuding and they begin to feel that they don't have to pretend that they're feeling at ease when they're not—their anxiety is understood and then they begin to relax.

We tell the newcomers about our set-up, in terms that they can relate to. We talk about why we've created this center and that we're glad that they've come to explore. After talking for a while, we suggest a computer game that might interest them, load the machine and let them settle in for the fun of confronting a new learning experience.

Adults and children relate to new learning situations in totally different ways. We have learned much from observing people with computers. Children seem to be very much attracted to the CRT terminal—because of their familiarity with TV and home video games, children between the ages of 7 and 10 feel very much at home with our microcomputers. Their attitudes towards the computers are open, eager and an almost matter-of-fact acceptance of the things that the technology of today has managed to accomplish. Older children, while equally open, seem to be more appreciative of the wonder of it all. They have reached a point in their own cognitive development to be able to imagine in abstract terms what a computer is and how it manages to do what it does. (There is a greater preponderance of 14 year old boys who frequent the center than any other age group.) So although children of different ages may be experiencing the computers differently, they all are unanimous in their enjoyment of and fearless approach to the machines.

On Saturdays MCC provides a place for families to come together in an attractive and calm environment for a unique "learning experience."

Adults, on the other hand, are less likely to welcome the challenge of this particular "unknown" with open minds. Adults come to the center with the whole gamut of preconceived attitudes, ideas and beliefs about computers. Their experience may have been in the form of a mistaken IRS refund, a cancelled magazine subscription that kept on coming or other annoyances that have been blamed on a computer foul up. With these kinds of things in mind, many adults come to the computer center ready for a fight, it seems. They are sour-faced individuals who wish that the animal "computerectus" would go on the endangered species list and not survive. Then there are women in the 35-50 age group who feel intimidated by the "superior" intelligence of computers. They are embarrassed that the computer will make them look foolish by knowing more than they do. Finally there are the older adults (in the 50-70 age range) who are bewildered by it all. They feel that the world is just moving too quickly and that they are being left behind.

After a direct experience with computers, one's fears are seen as groundless. Then the individual creates the opportunity for him/herself to really explore the computer as a new personal medium of creative expression.

One of the ways both adults and kids can do this is by taking one of our classes in computer programming. The classes are really an introduction to microcomputers and the computer languages BASIC (for adults and teenagers) and PILOT (for young children). Each course covers a brief history of computers—through vacuum tubes to transistors to integrated circuits to large scale integration; discussion of how a computer works and then right into learning the language and creating your own programs.

Our classes are for absolute beginners—no prior knowledge is assumed or expected. Since we personally tiptoed into the field without the usual prerequisites we fully understand and empathize with the fear and general uncertainty people bring with them into our classes. Because of this empathy we are particularly good at creating a safe learning environment for them to explore these "intelligent" machines.

Graduates of our courses have gotten right into the process of using computers in their lives for more fun, profit and efficiency. Some examples are: the man who created a program to calculate the milk production of his goats, the teacher who used the course to create specialized curriculum for his junior high school deaf students, the woman who was in charge of the reservations department in a large airlines and wanted to have more knowledge of computers to increase her feelings of effectiveness in her job and the 14 year old boy who has created and sold (to Processor Technology) a computer game called RACE.

One's success at survival has always been based on the ability to adapt; a willingness to change. With the world's increasing rate of change we've all got a challenge just to keep up with it. More important than keeping up with it is to be a part of that process of change. We at Marin Computer Center are giving people a wonderful opportunity to participate in that area of change in today's world known as "Computers." By directly interacting with computers, people begin experiencing new feelings of freedom and confidence, replacing their former fear and confusing overwhelm.

All of these people have an experience at the Computer Center which enables them to step outside of their preconditioned feelings of hostility, fear and confusion and enter a new world. A world that is not the dehumanizing robot world that they first imagined—but a world of people and learning and change instead. It's an exciting new world, and there is a place in it for everyone. The child in all of us is fascinated by computers—the "New Age Toy, Tool and Servant" of Humankind. ■

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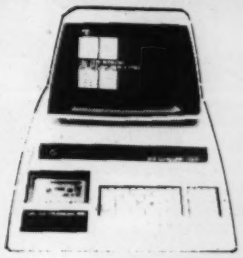

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CIRCLE 161 ON READER SERVICE CARD

Checker Challenger

Howard Ahl

"I enjoy checkers although I'm an average player at best. I think my moves have improved since playing with this electronic partner."

"Checker Challenger" qualifies as a complete pastime package as it serves all ages. It is an attainment game for the beginner and a challenge for the advanced player. There are two levels of play in Model CR (also known as Model '2'). The first level (L-1) gives the neophyte a good introduction and appreciation of the game of checkers and the second level (L-2) helps to sharpen the skill of the expert.

The course of play is clearly outlined in an instruction booklet and easily understood. Each dark square is numbered. When a move is made by the player, the numbers of the squares involved are then entered on the keyboard of the game board. The numbers light up in a display window. The computer selects a counter move and its numbers are revealed in the window. If the player makes an improper move, the window will show four dashes. If a mandatory jump is not taken, the letters "JP" will appear. Play continues when the player enters a correct move. At the conclusion of a match, a "win" or "lose" light will appear.

A notable feature is that a lengthy phone conversation or any other interruption does not affect the play. "Checker Challenger" is all solid state and designed to be left on for days or weeks. Another plus factor is position verification. If, by chance, the checkers become disarranged, a "PV" key will identify each square that should be covered.

After becoming familiar with the operation of the computer, I played 24 games on the first level, winning 17, losing 5 and with the other 2 resulting in a draw. On three occasions, it was apparent that the computer committed tactical errors, obviously to encourage a novice. However, one could become complacent and lose the match. Subsequent moves by the computer showed little or no weakness. Responses by the computer on the L-1 level were rapid, testifying to a remarkable programming of moves.

No obvious errors were made by the computer on the second level of play. Again, playing 24 matches, I won only 9 games and lost 13. Near the conclusion of two games, the computer malfunctioned, one indicating an illegal move and the other a jump. Neither command was valid. I had an instinctive feeling that perhaps the superior intelligence of the electronic brain recognized the possibility that it was going to lose! Giving it the benefit of the doubt, I considered these two matches to be a draw.

I suppose that two malfunctions in 48 games (with perhaps 200 moves per game) is not too unusual for such a complex electronics game — or is it? A 0.0416 error factor may be too high.

"Checker Challenger" is truly a "thinking machine" and should take a prominent position in the field of electronic games. It could become a welcome relief from boredom, especially for shut-ins, hospital patients and TV football widows.

"Checker Challenger" is manufactured by Fidelity Electronics, 5245 West Diversey Ave., Chicago, IL 60639 (312) 237-8090. It is widely available in retail outlets. Suggested list price is $75. ■

Howard Ahl, 1008 S.W. Meadowbrook Rd., Palm Bay, Fl. 32905.

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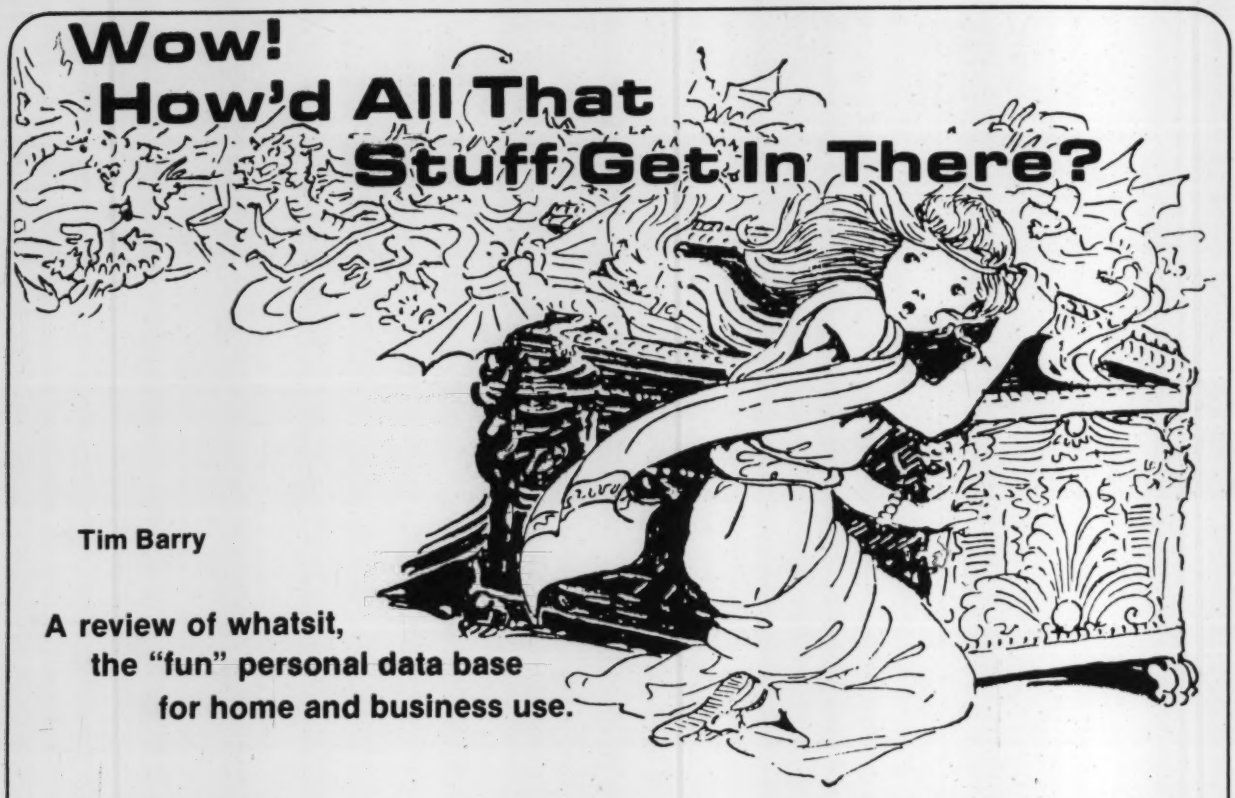

Tim Barry

A review of whatsit, the "fun" personal data base for home and business use.

"Whatsit" (Wow! How'd All That Stuff Get In There?) is a data base system written by Lyall Morrill, Jr. of Computer Headware. It is available for $125 from Information Unlimited, 331 W. 75th Place, Suite 2-1, Merrillville, Indiana 46410.

It's not often that I find myself completely in admiration of a software product. Many programs becoming available for mass distribution are really inadequate, and even the programs that are reasonably good tend to bring out the latent critic in me. I was, therefore, very pleasantly surprised when I became acquainted with WHATSIT.

WHATSIT is a small data base manager program designed for microcomputer users. It is available for both North Star and CP/M* disk systems. The North Star program is written in North Star BASIC (Version 6, Release 3), and requires a 24K North Star System. The source listings are included in the manual. The CP/M version is written in CBASIC and requires a minimum 40K CP/M system and CRUN, the CBASIC run time monitor. CRUN is not provided with WHATSIT so to use the CP/M version you need to have both CP/M and CBASIC. (CP/M and CBASIC are both widely advertised and available.) The source listing of the CBASIC version of WHATSIT is not provided, and it is not clear as to whether or not it is available.

Data base managers are programs designed to allow data to be stored and accessed according to user defined relationships. In general, the more complex the data relationships, the more complex and flexible the data base manager. WHATSIT is designed for small systems, but it provides a level of flexibility that is more than adequate for both hobbyists and small businesses.

Data is organized in WHATSIT according to Subject, Tag and Object indexes. When entering data you enter the first key (subject), second key (tag) and data entry (object). The individual keys and entries may be up to 30 characters each for North Star and up to 200 characters each for CP/M. New entries are automatically cross-indexed and entries can be deleted at any time. This allows you to keep WHATSIT continuously up to date.

Once the data is stored, you access it via spill requests (more commonly called "guerries"). You do this by entering a subject; tag; or object; or a subject and tag; subject and object; or tag and object pair. WHATSIT will spill all the elements associated with the specified key or keys. For example, if you enter a subject, WHATSIT will spill all tags and objects associated with that subject. If you enter a subject and tag pair you get the associated object.

The Northstar version of WHATSIT can hold up to 2000 entries on a single disk. The CP/M version can hold a whopping 25,000. As the size goes up the access times tend to get a bit long, but it's nothing compared to trying to find something on my perpetually messy desk. Access times can be minimized by regularly repacking the data base to remove obsolete or deleted entries. The utilities for deleting and repacking are included with WHATSIT.

No doubt this sounds a bit confusing, but don't worry. WHATSIT's command dialog is very conversational and easy to use. The manual is also very tutorial and presumes no knowledge of data bases or computer systems. Before long, you'll be storing and spilling information like a pro.

I've only had WHATSIT for two months, and I can already question how I ever lived without it. There are just so many things that can be stored, cross-referenced, listed, etc. I have used it to cross-index my record collection, monthly bills, phone directory, important dates, etc. I plan to do my coin collection, gourmet recipe file, wine lists and who knows what else. At work, it can be used for business cards, manufacturers literature, parts lists, etc. The program's structure and operation are so flexible that you can almost make up your own rules. ■

*CP/M is a registered trademark of Digital Research Corp.

Tim Barry, 46 Starlite Ct., Mountain View, CA 94043.

Sample Run of Whatsit. Computer responses are indented. Operator inputs at far left.

```
A>CRUN WHATSIT
CRUN VER 1.04


      WHATSIT
      A Creation of Computer Headware

      Loading ...

      Data Base's  6.1 percent full.

      Whatsit?
CREATIVE COMPUTING?
      CREATIVE COMPUTING's PUBLISHER's DAVID AHL
      CREATIVE COMPUTING's EDITOR's JOHN CRAIG
      CREATIVE COMPUTING's ADDRESS's PO BOX 789-M, MORRISTOWN NJ 07960
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      That's all!

      Whatsit?
CREATIVE COMPUTING'S PHONE ISN'T (201) 540-0444

      News to me!
      CREATIVE COMPUTING's PHONE was (201) 540-0444
      Replace it?
YES

      Tell me CREATIVE COMPUTING's new PHONE?
(201) 540-0445

      Indexing ...
      Got it!

      Whatsit?
WHAT'S CREATIVE COMPUTING'S PHONE?
      CREATIVE COMPUTING's PHONE's (201) 540-0445

      Whatsit?
BYE

      Bye for now!

      WHATSIT  Model CP-1
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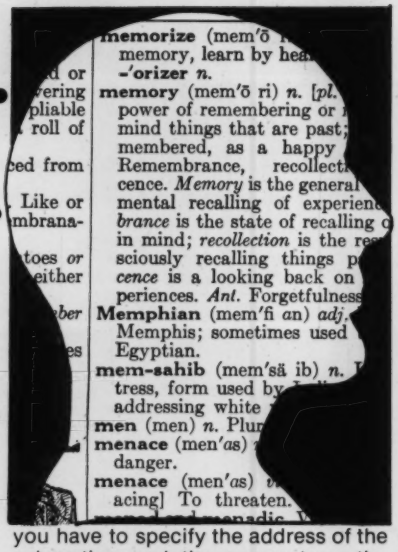
CIRCLE 186 ON READER SERVICE CARD

Interpretive Programming • • •

Norman Whaland • • • • •



Developing techniques for better usage of memory space has been a goal with programmers since the first program was written. The following methods should prove useful to those involved in assembly-language programming.

As microcomputer owners begin to develop larger and more interesting programs, memory will increasingly become a limiting factor. It's not helpful that even simple operations are liable to require several instructions on a microcomputer. Eventually the price of memory may drop enough for everyone to be able to afford 64K of memory. Meanwhile, programming techniques are available for squeezing surprisingly complicated programs into a small space.

The method described in this article is based on the presence in most programs of similar sequences of instructions that occur over and over. Such repetition can sometimes be reduced by using subroutines, but that method may require too much memory, as we shall see. It would be better to have powerful instructions to perform the repeated operations. This suggests designing a special-purpose computer tailored to the problem at hand. Then a program could be written to make the microcomputer mimic the special-purpose computer. Such a program is called an interpreter, and the instruction set of the special-purpose computer is called an interpretive language.

Writing an interpreter isn't as much trouble as it sounds, because the extra effort is repaid in the greater ease of writing the application program in the interpretive language. The main disadvantage of interpreters is that they are rather slow, but in most cases the increased running time should be an acceptable price for being able to run the program at all.

Calling Sequences

An instruction in an interpretive language can be viewed as a compressed form of the calling sequence for a subroutine. To call a subroutine you have to specify the address of the subroutine and the parameters—the data that it is to operate on (sometimes called arguments). Less memory is required if the parameters or their addresses are placed right after the instruction that jumps to the subroutine. Then the return address saved by the jump instruction also serves to point to the parameters. To pass the addresses of two parameters, a calling sequence on a typical microcomputer might have seven bytes, as shown in Figure 1. On some computers it is difficult to arrange to skip past the parameters when returning control to the main program. A more significant disadvantage, particularly when a program contains many calling sequences, is that this format is longer than is necessary.

The application program is written in an interpretive language especially designed for it. The interpretive instructions are carried out by an interpreter, consisting of a master routine and a collection of subroutines.

Interpretive Instructions

A program written for a small computer is unlikely to call more than 256 subroutines or refer to more than 256 data areas. Therefore we can use one-byte codes to refer to the subroutines and parameters. A scheme for doing this is shown in Figure 2. The seven-byte calling sequence is replaced by a three-byte interpretive instruction. The operation code of the instruction is an index to a table of subroutine addresses, and the operand codes are indices to a table of data addresses. A master routine examines the operation code and branches to the indicated subroutine.

We are led, then, to a method of programming that involves writing two programs instead of one. The application program is written in an interpretive language especially designed for it. The interpretive instructions are carried out by an interpreter, consisting of a master routine and a collection of subroutines. The work can be organized in the following stages:

- Determine what operations will have to be performed in the application program.
- Define the instructions of the interpretive language. At this stage the instructions can be written in a symbolic form, similar to assembler language.
- Write the application program in the interpretive language, adding more instructions to the language as needed.
- Decide upon the hexadecimal form of the interpretive instructions and write the interpreter.
- Manually translate the application program to hexadecimal code.

Designing the Language

Suppose that we intend to write a program that primarily manipulates sets. We might anticipate that the following operations would occur frequently in the program:

- The basic set operations of union, intersection, and difference.
- Determining whether a set is contained in another set.

Norman Whaland, 430 East 9th St., New York, NY 10009.

- Counting the elements of a set.
- Scanning a list of sets.
- Determining whether a set contains a given element.
- Arithmetic operations on integers.
- Moving sets and integers from one data area to another.

Having determined our general requirements, we can define the interpretive instructions we will need. Eventually the instructions will have to be written in hexadecimal code, but at this stage we can write them in symbolic form. Initially we might choose the following instructions:

UNION x,y	The union of sets x and y replaces set x.
ISECT x,y	The intersection of sets x and y replaces set x.
DIFF x,y	The difference of sets x and y replaces set x.
MVSET x,y	Set y replaces set x.
TESTINC x,y	The condition flag is set to true if set x is included in set y.
ADD n,m	The integer n+m replaces integer n.
SUB n,m	The integer n-m replaces integer n.
MVNUM n,m	Integer m replaces integer n.
TESTGT n,m	The condition flag is set to true if integer n is greater than integer m.
TESTEQ n,m	The condition flag is set to true if integer n is equal to integer m.
COUNT n,x	The number of elements in set x replaces integer n.
NEXT a	The address a of a set in a list is replaced by the address of the next set in the list. If there is no next set, the condition flag is set to false.
MVADDR a,b	Address b replaces address a.
B j	Control passes to the LABEL instruction with operand j.
BT j	If the condition flag is true, control passes to the LABEL instruction with operand j.
BF j	If the condition flag is false, control passes to the LABEL instruction with operand j.
j LABEL	Control passes to the next instruction. (The operand is written at the left to make programs more readable. In the hexadecimal form the operand will follow the operation code, as for other instructions.)

The lower-case letters stand for symbolic operands, data, or addresses, depending on context. For example, in the expression MVSET x,y the x and y stand for symbolic operands. They in turn stand for indices to addresses of data areas that contain sets, which are referred to by the x and y in the description of the instruction. Thus, for the data configuration shown in Figure 3, the instruction MVSET W,A causes SET A to replace SET W. Note particularly the different effect of MVADDR W,A, which changes entry W of the address table to point to SET A but doesn't alter the data areas.

The branch instructions B, BT, and BF are defined in such a way as to avoid the need to calculate addresses when writing the program, at the cost of the space taken by the LABEL instructions. The first time that the interpreter executes a branch instruction, it must search the program for the LABEL instruction with the same operand. Then it can replace the operand of the branch instruction with the machine address of the LABEL instruction, simultaneously altering the branch instruction to indicate that the replacement was made. When the branch is taken later, no time-consuming search will be required.

During the writing of the application program, additional instructions will probably have to be defined. Because each new instruction will add to the size of the interpreter, you should be alert for creative ways of using existing instructions. For example: (1) Rather than define an instruction to test whether a set is empty, TESTINC can be used to determine whether it is included in an empty set. (2) Sets can be used as flags, empty meaning false and non-empty meaning true. (3) Elements can be represented as sets of one, to avoid the need for separate instructions to add an element to a set, test whether an element is contained in

Fig. 1. A typical calling sequence.

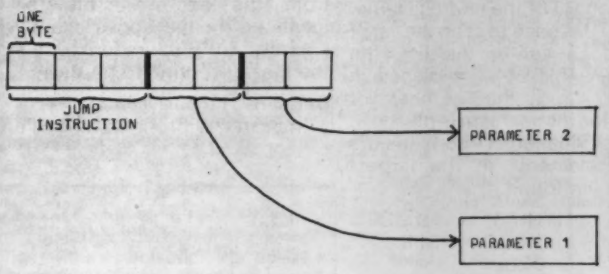
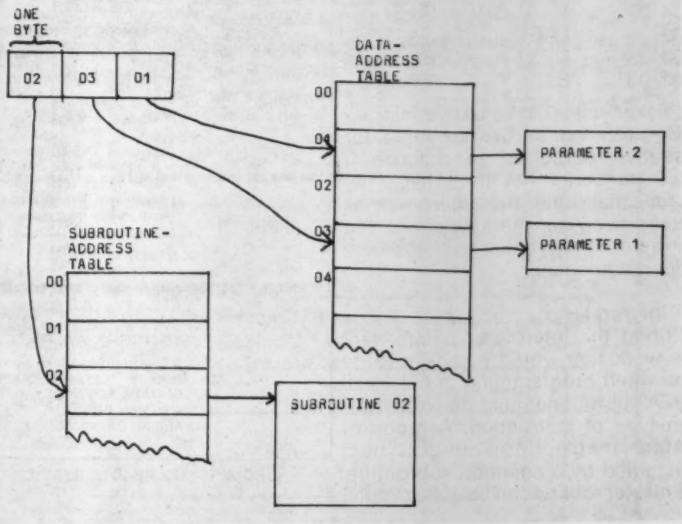


Fig. 2. An interpretive instruction.



a set, and so on.

Parts of the application program may perform operations unlike any needed elsewhere. Rather than define instructions that will be used only once, you can arrange to escape from the interpretive language and write those parts of the program directly in assembler language. This can be accomplished by an interpretive instruction that tells the interpreter to transfer control to machine code directly following. Interpretive programming is resumed by a jump to the interpreter.

The Application Program

Once a tentative instruction set has been defined, the application program can be written. The detailed specification of the data representation and the design of the interpreter are best left to a later stage, because deficiencies in the interpretive language are likely to come to light.

To illustrate the use of the interpretive language, suppose that in Figure 3 we wish to search the list SET B1, SET B2, SET B3, ... for the set that has the largest number of elements in common with SET A. The following code places the address of the desired set in location BJ of the address table. The pointer BI is used to scan the list of sets. For each set in the list, the intersection with SET A is placed in location W, and the number of elements in the intersection is placed in location N2. Location N1 contains the number of elements in the largest intersection yet found.

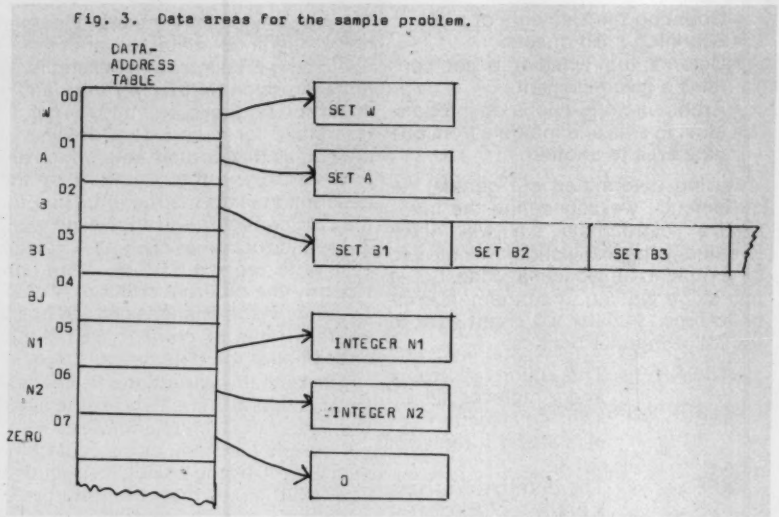
```
87 05 07        MVNUM    N1,ZERO
0C 03 02        MVADDR   BI,B
0E 01       X1  LABEL
83 00 01        MVSET    W,A
81 00 03        ISECT    W,BI
8A 06 00        COUNT    N2,W
88 06 05        TESTGT   N2,N1
4D 02 00        BF       X2
87 05 06        MVNUM    N1,N2
0C 04 03        MVADDR   BJ,BI
0E 02       X2  LABEL
0B 03           NEXT     BI
2D 01 00        BT       X1
```

The hexadecimal form of the instructions is shown in this example for illustrative purposes. In practice it would be better not to translate to hexadecimal until the interpreter is written, because the design of the interpreter might influence the choice of operation codes.

The Interpreter

Writing the interpreter entails very little work that would not have to be done when programming in the usual way. A subroutine must be written for each type of instruction. A group of related instructions might best be handled by a common subroutine. The master routine can be quite simple.

Fig. 3. Data areas for the sample problem.



Its main function is to inspect the operation code and branch to the relevant subroutine. A location counter will be needed to point to the next instruction to be executed. When the instruction operates on data, it would be helpful for the master routine to move the addresses of the operands from the address table to fixed locations. In the above example, the sign bit in the operation code signals the master routine to do this.

Benefits

Interpretive programming is a good method for squeezing programs into a small computer. There are other advantages. Tackling the program in two stages makes it easier to write. Only the broad questions of program logic need be answered when the application program is written; the details are handled when the interpreter is written. The interpretive language is good documentation, because it is more concise and descriptive than assembler language. Far from being burdensome, interpretive programming can actually save effort. ■

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An Intelligent Calendar For every home

Gary Young

When is that loan payment due? Is Aunt Elizabeth's birthday this month? Reminders for these, and many other events are possible with this unique calendar.

Have you ever missed a birthday or bill payment because you forgot to mark it on your calendar? Would you like to glance at the calendar and see all paydays marked, see what bills had to be paid, and see the balance on each account before that payment is made? Do you need a calendar that is large enough to write in other information? This BASIC program generates just such a calendar. It is written in Northstar BASIC (release 4) and requires about 8K of memory.

The program has two modes of operation. One mode maintains the data file, and the other mode prints the calendar. The data file contains information to be printed on the calendar. Each record consists of a nine-character description of the event or bill to be printed on the calendar, the month and day of the first occurrence, the frequency of the occurrence, payment amount and beginning balance. The frequency occurrence must be one of the following: 1-yearly, 2-semiannually, 4-quarterly, 12-monthly, 24-semimonthly, 26-bi-weekly, or 52-weekly. The program will automatically increment the dates forward and decrease the balance. The payment amount and beginning balance should be zero for any items for which these figures are not applicable (i.e. birthdays, holidays, paydays, etc.). The payment should be positive and the balance zero for items that will never be fully paid (e.g., rent, utilities, etc.). Otherwise the balance will be decremented by the payment each time a payment is made and both the payment and the balance will print under the description on the date due. They will stop being printed when the item is paid off. Since there is only room for three entries on each day, the data should be entered in decreasing priority so that the most important references are sure to be printed. The data need not be in order by date.

When the program begins, the prompt "ENTER CREATE, ADD, CHANGE, DELETE, LIST OR RUN?" will be printed. The first time the program is executed, enter "CREATE." This will cause the program to begin writing a file named CALDATA. It will then prompt with the record number and ask for the nine-character description. Then it will ask for the starting month and day, frequency, payment, and beginning balance. The month, day, and frequency will be edited for valid data, and the payment and balance amounts will be truncated to whole dollars. Up to forty data items can currently be entered although this can easily be changed by enlarging the D9 and D9$ arrays. Data will continue to be requested until only a carriage return is entered when the program requests the description. The program will then request the next command.

The "ADD" command is used to append data to the end of the file. After positioning to the end of the data, the program branches to the "CREATE" routine, and continues accepting data.

To check the data entered, use the "LIST" command. The data will be formatted and printed along with the record number. This record number is used in the "CHANGE" and "DELETE" commands.

The "CHANGE" command will request the record number to be changed. A random read is done to position to that record. The program will then request the new data. Enter all of the data again for that record even if only part of it has changed. Then a random write is done to replace the data in the file. By entering zero when it requests a record number, the program will terminate the "CHANGE" command, and accept a new command. The "DELETE" command is similar to the "CHANGE" command. It puts the word "deleted" in the description so that the record is ignored when the calendar is run. The record can later be changed to other valid data since it is not physically removed from the file.

Once all of the data has been entered, type the command "RUN." The program will request the starting year, month and number of calendars to print. It will first pause while it advances the dates and amounts from the starting date to the month of the first calendar.

The calendar is complete with boxes to write in, days, dates, events, payments and balances. The only thing not generated is a picture at the top of each month, but I am sure that some imaginative reader can supply a program to generate a picture of Snoopy for each month. ■

Gary Young, PO Box 66572, Los Angeles, CA 90066.

```
1000 REM SURF COMPUTER SERVICES BUSINESS SOFTWARE
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1300 REM THESE MATERIALS SHALL NOT BE COPIED, REPRODUCED, LENT,
1400 REM RENTED, NOR SOLD IN ANY FORM WHATSOEVER WITHOUT PRIOR
1500 REM WRITTEN CONSENT FROM GARY YOUNG.
1600 REM
1700 V=5
1800 PRINT "INTELLIGENT CALENDAR VERSION",V
1900 DIM B$(9),A(12),T(12),D$(63),M$(108)
2000 REM ARRAYS ARE SET FOR 40 DESCRIPTIONS
2100 DIM D9$(360),D9(40,6)
2200 DIM L(7,2)
2300 DATA 31,28,31,30,31,30,31,31,30,31,30,31
2400 DATA 0,31,59,90,120,151,181,212,243,273,304,334
2500 DATA " SUNDAY  "
2600 DATA " MONDAY  "
2700 DATA " TUESDAY "
2800 DATA "WEDNESDAY"
2900 DATA " THURSDAY"
3000 DATA " FRIDAY  "
3100 DATA " SATURDAY"
3200 DATA " JANUARY "
3300 DATA " FEBRUARY"
3400 DATA "  MARCH  "
3500 DATA "  APRIL  "
3600 DATA "   MAY   "
3700 DATA "   JUNE  "
3800 DATA "   JULY  "
3900 DATA "  AUGUST "
4000 DATA "SEPTEMBER"
4100 DATA " OCTOBER "
4200 DATA "NOVEMBER "
4300 DATA "DECEMBER "
4400 FOR N=1 TO 12\ READ A(N)\ NEXT N
4500 FOR N=1 TO 12\ READ T(N)\ NEXT N
4600 FOR N=0 TO 6\ READ B$\ L=N*9+1\ D$(L,L+8)=B$\ NEXT N
4700 FOR N=0 TO 11\ READ B$\ L=N*9+1\ M$(L,L+8)=B$\ NEXT N
4800 PRINT "ENTER CREATE, ADD, CHANGE, DELETE, LIST, OR ",
4900 INPUT "RUN? ",F$
5000 IF LEN (F$)=0 THEN END
5100 IF F$="CREATE" THEN 24600
5200 IF F$="ADD" THEN 26500
5300 IF F$="CHANGE" THEN  27200
5400 IF F$="DELETE" THEN 27200
5500 IF F$="LIST" THEN 29300
5600 IF F$="RUN" THEN 5900
5700 PRINT "INVALID COMMAND"
5800 GOTO 4800
5900 OPEN #1,"CALDATA"
6000 J=0
6100 IF TYP(1)=0 THEN 7400
6200 J=J+1
6300 READ #1,B$
6400 FOR K=1 TO 5
6500 READ #1,D9(J,K)
6600 NEXT K
6700 IF B$<>"DELETED  " THEN 7000
6800 K=K-1
6900 GOTO 6100
7000 D9(J,6)=0
7100 K=(J-1)*9+1
7200 D9$(K,K+8)=B$
7300 GOTO 6100
7400 N8=J
7500 INPUT "ENTER STARTING YEAR, MONTH AND NO OF MONTHS? ",Y9,M9,N9
7600 REM IF LEAP YEAR, ADVANCE THE DATE ARRAY
7700 IF Y9=INT(Y9/4)*4 THEN GOSUB 24000
7800 REM IT WILL TAKE A FEW SECONDS TO ADVANCE THE DATES
7900 REM DON'T THINK THE SYSTEM IS HUNG UP
8000 GOSUB 22600
8100 M9=M9-1
8200 N1=0
8300 N1=N1+1
8400 IF N1>N9 THEN END
8500 M9=M9+1
8600 IF M9<13 THEN 8800
8700 M9=1\Y9=Y9+1
8800 Y7=Y9
8900 M7=M9
9000 D9=1\D7=1
9100 GOSUB 15200
9200 IF W7>1 THEN D9=D9-W7+1
9300 REM PRINT HEADINGS
9400 PRINT\PRINT\PRINT
9500 FOR J=1 TO 70\ PRINT "*",\ NEXT J
9600 PRINT\PRINT\PRINT TAB(24),
9700 FOR J=1 TO 9\ K=(M9-1)*9+J\ PRINT " ",M$(K,K),\ NEXT J
9800 PRINT "  19",%2I,Y9\PRINT
9900 FOR J=0 TO 6\ K=J*9+1\ PRINT " ",D$(K,K+8),\ NEXT J
10000 PRINT
10100 FOR J=1 TO 71\ PRINT "*",\ NEXT J\ PRINT
10200 REM PRINT BODY OF CALENDAR
10300 N2=0
10400 N2=N2+1
10500 REM N2 IS NUMBER OF LINES IN DAY BOX
10600 IF N2>7  THEN 13200
10700 S=0
10800 T=-10
10900 REM D1 IS THE CURRENT DAY IN THE MONTH
11000 D1=D9
11100 REM T IS THE TAB POSITION
11200 T=T+10
11300 REM S IS THE DAY OF THE WEEK COUNTER
11400 S=S+1
11500 PRINT TAB(T),"*",
11600 IF T>69 THEN 12700
11700 REM ON THE FIRST LINE OF THE WEEK, PRINT THE DATE
11800 IF N2>1 THEN 12300
11900 IF D1<1 THEN 12500
12000 REM DO NOT PRINT DAYS FOR PRIOR OR LATER MONTH
12100 IF D1>A(M9) THEN 12500
12200 PRINT TAB(T+5),%2I,D1,
12300 IF N2=2 OR N2=4 OR N2=6 THEN GOSUB 20000
12400 IF N2=3 OR N2=5 OR N2=7 THEN GOSUB 21800
12500 D1=D1+1
12600 GOTO 11200
12700 PRINT
12800 GOTO 10400
12900 REM
13000 REM AT END OF WEEK, PRINT FULL BOTTOM LINE AND CLEAR FLAGS
13100 REM
13200 FOR J=1 TO 71\ PRINT "*",\ NEXT J\ PRINT
```


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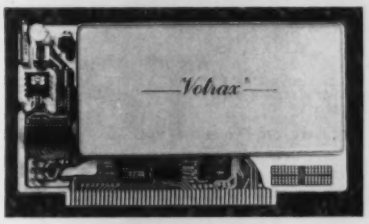

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CIRCLE 177 ON READER SERVICE CARD

```
13300 FOR J=1 TO N8\ D9(J,6)=0\ NEXT J
13400 REM
13500 REM ADVANCE ALL THE DATES FROM THIS WEEK
13600 REM THE ADVANCING IS DONE HERE INSTEAD OF AT EACH DAY BECAUSE
13700 REM THOSE EVENTS OVER 3 FOR THAT DAY WOULD NOT BE ADVANCED
13800 REM
13900 FOR D1=D9 TO D9+6
14000 IF D1<1 OR D1>A(M9) THEN 14600
14100 FOR Q=1 TO N8
14200 IF M9<>D9(Q,1) THEN 14500
14300 IF D1<>D9(Q,2) THEN 14500
14400 GOSUB 16200
14500 NEXT Q
14600 NEXT D1
14700 D9=D9+7
14800 REM CHECK FOR END OF MONTH
14900 IF D9+1>A(M9) THEN 8300
15000 GOTO 10300
15100 REM
15200 REM CALCULATE THE DAY OF THE WEEK
15300 REM
15400 T7=INT(D7+365.25*Y7+T(M7)+.01*M7-.03)
15500 W7=T7-INT((T7+1)/7)*7
15600 W7=W7+1
15700 IF W7=8 THEN W7=1
15800 RETURN
15900 REM
16000 REM INCREMENT TO NEXT PERIOD
16100 REM
16200 M=D9(Q,1)
16300 D=D9(Q,2)
16400 F=D9(Q,3)
16500 IF F=1 THEN 19200
16600 IF F<>2 THEN 17100
16700 M=M+6
16800 IF M>12 THEN M=M-12
16900 IF D>A(M) THEN D=A(M)
17000 GOTO 19200
17100 IF F<>4 THEN 17400
17200 M=M+3
17300 GOTO 16800
17400 IF F<>12 THEN 17700
17500 M=M+1
17600 GOTO 16800
17700 IF F<>24 THEN 18400
17800 IF D<>A(M) THEN 18200
17900 D=15
18000 M=M+1
18100 GOTO 16800
18200 IF D=15 THEN D=A(M)
18300 GOTO 19200
18400 IF F<>26 THEN 18900
18500 D=D+14
18600 IF D<A(M) OR D=A(M) THEN 19200
18700 D=D-A(M)
18800 GOTO 17500
18900 IF F<>52 THEN STOP
19000 D=D+7
19100 GOTO 18600
19200 IF D9(Q,5)<1 THEN 19600
19300 D9(Q,5)=D9(Q,5)-D9(Q,4)
19400 IF D9(Q,5)>1 THEN 19600
19500 D9(Q,4)=D9(Q,4)+D9(Q,5)
19600 D9(Q,1)=M\D9(Q,2)=D
19700 RETURN
19800 REM
19900 REM PRINT DESCRIPTION
20000 FOR Q=1 TO N8
20100 IF D9(Q,6)=1 THEN 21300
20200 IF M9<>D9(Q,1) THEN 21300
20300 IF D1<>D9(Q,2) THEN 21300
20400 N=(Q-1)*9+1
20500 PRINT D9$(N,N+8),
20600 D9(Q,6)=1
20700 L(S,1)=D9(Q,4)
20800 L(S,2)=D9(Q,5)
20900 IF D9(Q,5)>0 OR D9(Q,5)=0 THEN 21200
21000 D9(Q,4)=0\D9(Q,5)=0
21100 D9(Q,1)=99
21200 EXIT 21400
21300 NEXT Q
21400 RETURN
21500 REM
21600 REM PRINT PAYMENT AMOUNT AND BALANCE
21700 REM
21800 IF L(S,1)>0 THEN PRINT %4I,INT(L(S,1)),
21900 IF L(S,2)>0 THEN PRINT %5I,INT(L(S,2)),
22000 L(S,1)=0\ L(S,2)=0
22100 RETURN
22200 REM
22300 REM M5 IS THE MONTH OF THE EARLIEST DATE IN THE DATA
22400 REM IT IS USED TO CALCULATE FORWARD TO A LATER DATE
22500 REM DATA WITH A MONTH PRIOR TO M5 IS CONSIDERED AS NEXT YEAR
22600 M5=1
22700 FOR Q=1 TO N8
22800 IF D9(Q,3)=1 THEN 23800
22900 IF M5>M9 THEN 23400
23000 IF D9(Q,1)<M9 THEN 23100 ELSE 23800
23100 IF D9(Q,1)<M5 THEN 23800
23200 GOSUB 16200
23300 GOTO 23000
23400 IF D9(Q,1)<M9 THEN 23600
23500 IF D9(Q,1)<M5 THEN 23800
23600 GOSUB 16200
23700 GOTO 23400
23800 NEXT Q
23900 RETURN
24000 REM ADVANCE THE DATES FOR A LEAP YEAR
24100 A(2)=29
24200 FOR J=2 TO 12
24300 T(J)=T(J)+1
24400 NEXT J
24500 RETURN
24600 REM CREATE CALDATA FILE
24700 OPEN #1,"CALDATA"
24800 K=0
24900 PRINT "ENTER DESCRIPTION ON LINE 1"
25000 PRINT "ENTER START MO, START DAY, FREQ, PAYMT, BALANCE ON LINE 2"
25100 PRINT "ENTER ONLY CARRIAGE RETURN ON DESCRIPTION TO END"
25200 K=K+1
25300 PRINT K,
25400 INPUT " DESC? ",B$
25500 IF LEN(B$)=0 THEN 26300
25600 INPUT "M,D,F,P,B? ",S1,S2,F1,P1,B1
25700 GOSUB 30600
25800 IF E9>0 THEN 25300
25900 D9$(1,9)="          "
26000 D9$(1,9)=B$
26100 WRITE #1,D9$(1,9),S1,S2,F1,P1,B1
26200 GOTO 25200
26300 CLOSE #1
26400 GOTO 4800
26500 REM ADD ENTRIES TO BOTTOM OF DATA LIST
26600 OPEN #1,"CALDATA"
26700 K=0
26800 IF TYP(1)=0 THEN 24900
26900 READ #1,B$,S1,S2,F1,P1,B1
27000 K=K+1
27100 GOTO 26800
27200 REM CHANGE OR DELETE CODE
27300 REM A DELETE IS JUST A CHANGE WITH THE DESC=DELETE
27400 OPEN #1,"CALDATA"
27500 PRINT "ENTER RECORD NO 0 TO TERMINATE"
27600 INPUT "RECORD NO? ",R
27700 IF R=0 THEN 26300
27800 J=(R-1)*36
27900 READ #1%J,B$,S1,S2,F1,P1,B1
28000 IF F$="CHANGE" THEN 28400
28100 B$="DELETED  "
28200 WRITE #1%J,B$,S1,S2,F1,P1,B1,NOENDMARK
28300 GOTO 27600
28400 INPUT "DESC? ",B$
28500 IF LEN(B$)=0 THEN 26300
28600 INPUT "M,D,F,P,B? ",S1,S2,F1,P1,B1
28700 GOSUB 30600
28800 IF E9>0 THEN 28400
28900 D9$(1,9)="          "
29000 D9$(1,9)=B$
29100 B$=D9$(1,9)
29200 GOTO 28200
29300 REM LIST THE FILE
29400 OPEN #1,"CALDATA"
29500 K=0
29600 PRINT
29700 PRINT "NO.  DESCRIPTION  START  FREQ  PAYMT  BALANCE"
29800 IF TYP(1)=0 THEN 30400
29900 READ #1,B$,S1,S2,F1,P1,B1
30000 K=K+1
30100 PRINT %3I,K,"   ",B$(1,9),"   ",%2I,S1,"/",%2I,S2,"   ",
30200 PRINT %2I,F1,%8I,P1,%9I,B1
30300 GOTO 29800
30400 PRINT\PRINT
30500 GOTO 26300
30600 REM EDIT THE INPUT DATA
30700 E9=0
30800 P1=INT(P1)
30900 B1=INT(B1)
31000 IF S1<1 THEN 32100
31100 IF S1>12 THEN 32100
31200 IF S2<1 THEN 32100
31300 IF S2>A(S1) THEN 32100
31400 IF F1=1 THEN RETURN
31500 IF F1=2 THEN RETURN
31600 IF F1=4 THEN RETURN
31700 IF F1=12 THEN RETURN
31800 IF F1=24 THEN RETURN
31900 IF F1=26 THEN RETURN
32000 IF F1=52 THEN RETURN
32100 PRINT "ERROR IN DATA"
32200 E9=1
32300 RETURN
READY
```

```
RUN

INTELLIGENT CALENDAR VERSION 5
ENTER CREATE, ADD, CHANGE, DELETE, LIST, OR RUN? CREATE
ENTER DESCRIPTION ON LINE 1
ENTER START MO, START DAY, FREQ, PAYMT, BALANCE ON LINE 2
ENTER ONLY CARRIAGE RETURN ON DESCRIPTION TO END
 1 DESC? WEEKLY
M,D,F,P,B? 1,5,52,0,0
 2 DESC? BIWEEKLY
M,D,F,P,B? 1,12,26,0,0
 3 DESC? MONTHLY
M,D,F,P,B? 1,30,12,0,0
 4 DESC? SEMIMONTHLY
M,D,F,P,B? 1,15,24,0,0
 5 DESC? PAYDAY
M,D,F,P,B? 1,3,26,0,0
 6 DESC? BIRTHDAY
M,D,F,P,B? 1,8,1,0,0
 7 DESC? RENT
M,D,F,P,B? 1,1,12,250,0
 8 DESC? LOAN
M,D,F,P,B? 1,10,12,100,2000
 9 DESC? VISA
M,D,F,P,B? 1,10,12,25,300
 10 DESC?
ENTER CREATE, ADD, CHANGE, DELETE, LIST, OR RUN? ADD
ENTER DESCRIPTION ON LINE 1
ENTER START MO, START DAY, FREQ, PAYMT, BALANCE ON LINE 2
ENTER ONLY CARRIAGE RETURN ON DESCRIPTION TO END
 10 DESC? TO BE DELTED
M,D,F,P,B? 1,2,12,0,0
 11 DESC? BAD DATA
M,D,F,P,B? 12,99,1,0,0
ERROR IN DATA
 11 DESC?
ENTER CREATE, ADD, CHANGE, DELETE, LIST, OR RUN? LIST

NO.  DESCRIPTION  START  FREQ  PAYMT  BALANCE
  1   WEEKLY       1/ 5   52      0        0
  2   BIWEEKLY     1/12   26      0        0
  3   MONTHLY      1/30   12      0        0
  4   SEMIMONTH    1/15   24      0        0
  5   PAYDAY       1/ 3   26      0        0
  6   BIRTHDAY     1/ 8    1      0        0
  7   RENT         1/ 1   12    250        0
  8   LOAN         1/10   12    100     2000
  9   VISA         1/10   12     25      300
 10   TO BE DEL    1/ 2   12      0        0
```

```
ENTER CREATE, ADD, CHANGE, DELETE, LIST, OR RUN? DELETE
ENTER RECORD NO 0 TO TERMINATE
RECORD NO? 10
RECORD NO? 0
ENTER CREATE, ADD, CHANGE, DELETE, LIST, OR RUN? CHANGE
ENTER RECORD NO 0 TO TERMINATE
RECORD NO? 4
DESC? SEMIMNLY
M,D,F,P,B? 1,15,24,30,300
RECORD NO? 0
ENTER CREATE, ADD, CHANGE, DELETE, LIST, OR RUN? LIST

NO.  DESCRIPTION  START  FREQ  PAYMT  BALANCE
  1   WEEKLY       1/ 5   52      0        0
  2   BIWEEKLY     1/12   26      0        0
  3   MONTHLY      1/30   12      0        0
  4   SEMIMNLY     1/15   24     30      300
  5   PAYDAY       1/ 3   26      0        0
  6   BIRTHDAY     1/ 8    1      0        0
  7   RENT         1/ 1   12    250        0
  8   LOAN         1/10   12    100     2000
  9   VISA         1/10   12     25      300
 10   DELETED      1/ 2   12      0        0

ENTER CREATE, ADD, CHANGE, DELETE, LIST, OR RUN? RUN
ENTER STARTING YEAR, MONTH AND NO OF MONTHS? 79,1,2
```

JANUARY 1979

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
	1	2	3	4	5	6
	*RENT		*PAYDAY		*WEEKLY	
	* 250					
7	8	9	10	11	12	13
	*BIRTHDAY		*LOAN		*WEEKLY	
			* 100 2000*			
			*VISA		*BIWEEKLY	
			* 25 300*			
14	15	16	17	18	19	20
	*SEMIMNLY		*PAYDAY		*WEEKLY	
	* 30 300*					
21	22	23	24	25	26	27
					*WEEKLY	
					*BIWEEKLY	
28	29	30	31			
		*MONTHLY	*SEMIMNLY			
			* 30 270*			
			*PAYDAY			

FEBRUARY 1979

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
				1	2	3
				*RENT	*WEEKLY	
				* 250		
4	5	6	7	8	9	10
					*WEEKLY	*LOAN
						* 100 1900*
					*BIWEEKLY	*VISA
						* 25 275*
11	12	13	14	15	16	17
			*PAYDAY	*SEMIMNLY	*WEEKLY	
				* 30 240*		
18	19	20	21	22	23	24
					*WEEKLY	
					*BIWEEKLY	
25	26	27	28			
			*MONTHLY			
			*SEMIMNLY			
			* 30 210*			
			*PAYDAY			

```
READY
```


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CONTENTS

Warning 1
Standards 2
Good Guy Awards 4
Resources 5
Letters 10, 14, 47, 54, 55
Pet Hints 20, 28, 32, 78, 79
Machine Language 24, 71
Music Convention 26, 34, 36
Data Files 38
Joysticks 42
On Goto 45
Info Summary 50
PET Clubs 54
Program Overlays 58
Program Protection 60
PET poun 61, 62, 66
Memory Map 70, 88
Basic Abbreviations 71
PET Symbol Table & Data Format 74
Decoder 76
Dynamic Keyboard 80
Tape Hints 83
Microsette 85
PET Cassette Exchange 93
Free Software 95

PROGRAM LISTINGS

Auto Line Eraser — Lindsay 68
Auto Line Eraser (Annotated) — Lindsay 68
Auto Line Number — Lindsay/Weiner 63
Automatic Line Numbering — Merlissa 75
Case Tester — Weiler 61
File Manager 3 — Cumberton 28
5 PI FIND/CORRECT/SELF ERASE — Lindsay 60
Hex Data Read Routine 71
Keyboard Buffer Display — Irving 14
Mem Explorer/Decoder — Busolecker 77
No List Demo — Lindsay 60
ON GOSUB Example — Lindsay 64
Password — Sosnowski 16
Patterns — Wachter 24
Plot 72
Print Screen Contents 72
Renumber 60
Repeat Key Routine — Software Shoppe 30
Sound Input Routine — Lindsay 24
Taps (Music) — Adams 16

REVIEWS

Accounting Pack 1 — Sawyer Software 46
Add 'em Up — Jamestown Small Computer Sys 40
Anti Aircraft — New England Electronics 40
Asteroids — ZZYP Data Processing 38
Baccarat — CMS 41
Baseball — Brinson 38
Bets — Forethought Products 50
Big KB Keyboard — Skyles Electronic Works 38
Big KB Memory — Skyles Electronic Works 38
Billboard — Micro Software Systems 39
Black Bart (Poker) — ZZYP Data Processing 41
Black Box — Dr. Daley 88
Black Brat (Blackjack) — ZZYP Data Processing 41
Blackjack — CMS 41
Blackjack — JK Johnson 41
Block — ZZYP Data Processing 87
Bombadier — New England Electronics 40
Budget — Petshack 86
Cassette Tapes — Dr. Daley 8
Cassette Tapes — Full Compass 85
Cassette Tapes — Microsette 95
Cassette Tapes — Pyramid Data 87
Channel Data Book — Channel Data Systems 87
Chase — Dr. Daley 84
Checkers — CMS 87
Checking Account — Computers One 82
Check Management — Jamestown Small Computer Systems 40
Chessboard — Sawyer Software 87
Commodore PET User Club Newsletter (England) 24, 55
Computer Derby — Petshack 47
Computone — Microsignal 38
Craps — CMS 41
Cursor 6, 66
Depth Charge — New England Electronics 40
Dictator — Dr. Daley 50
Dogfight — New England Electronics 40
Extended Graphics — Software Shoppe 88
Football — ZZYP Data Processing 87
Football 2 — Dr. Daley 12
General Ledger — Computers One 82
Gomoku — CMS 12
Hangman — YP Data Processing 86
Hangman — Mike Richter 87
Hunt'er'ter — Mike Richter 87
Iron Planet — ZZYP Data Processing 84
Joysticks — Coyote Electronics 43
Joysticks — Microtronix 42
Keyboard — Excel 87
Kingdom — Personal Software 47
Kriss — A&B Computers 89
Legal Diary — Computers One 82
LEM Landing from Moon Orbit — Alpha Omega Software 53
Life — Smith Business Services 46
Matador — Personal Software 95
Math Tutor — Petshack 47
Mastr — H. Saal 55
Medit — Total Information Service 98
Metric Calc — Micro Software Systems 87
Microchess — Personal Software 40
Micro Sel 1 — Micro Software Systems 88
Missile — Software Industries 38
Monitor — Petshack 55
Monitor — Smith Business 55
Morse Code — Dr. Daley 36
Music Box — New England Electronics 38
Numberama — Petshack 41
One Queen — Personal Software 95
Petabe — Program/Petabe 83
PET Data Sheets — Alcorn Data Service 50
PET Dust Cover — New England Electronics 6
Petforth — Programma Consultants 48
PET Info Packet — New England Electronics 18
PET Tutor — Paper 50
PET Workbooks — Total Information Service 82
Poker — Personal Software 41
Practical Computing 58
Printer Adapter — Connecticut Microcomputer 8
Program — Program/Petabe 88
Purser Cassette Reference List — Purser 34
Quest — Computer Project 87
Quibic — CMS 12
Read, Write PET Memory — Ketchum 18
Rent Accounts — Computers One 82
Roulette — CMS 41
Schedule Planner — Sawyer Software 54
Sharks — Reich Engineering 84
6502 Disassembler & PEEK — Petshack 55
Slot Machine — Reich Engineering 84
Some Common Basic Programs — Osborne & Assoc 54
Star Fighter — ZZYP Data Processing 38
Startrek — Petshack 84
Startrek — Dad's Reliable Software 84
Startrek — Smith Business Services 84
Startrek — Dr. Daley 84
Starwars — Software Industries 38
Swee Ping — Micro Software Systems 47, 89
Swordquest — Fantasy Software Games 87
TNW 488-103 Low Speed Modem — Networks 8
TNW 488-232 Serial Interface Module — Networks 8
Traverse & Curvelntersect — A H McCann 12
Trust Accounts — Computers One 82
Video Checkers — Compu Quote 12
Word Processor Program — Connecticut Microcomputer 46
Wumpus — PET Cassette Exchange 66
ZZAPP — Dr. Daley 84

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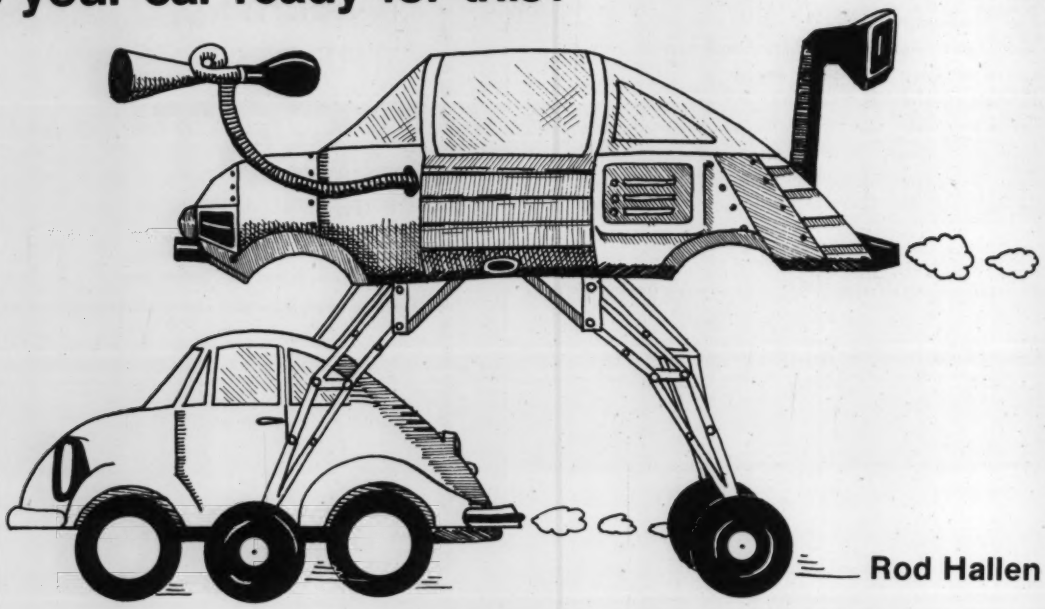


Rod Hallen

Does an automotive computer system have a place in a magazine for personal computers? More importantly, does that computer have a place in your car?

I would like to assume that everyone reading this either has a personal computer or is planning to get one. However, while Compucruise cannot really be classed as a personal computer in the sense that we normally use that phrase, it certainly takes advantage of the technology that we take for granted and enjoy. It should, therefore, be of some interest to you.

Photo 1 shows the Command Module of the Compucruise system which is manufactured by Zemco, Incorporated (Note 1). Compucruise is an automotive computer, cruise control and clock combined in one unit. It provides forty-four different functions all of which are listed in Table 1. Note that the English units: miles, gallons and degrees Fahrenheit can also be displayed in metric terms: kilometers, liters, and degrees Celsius at the touch of the "M" (Metric) button.

Most cars have a clock of one kind or another and many have the cruise control feature but the rest of the functions will be new to most drivers. Cadillac has an option that they call "Trip Computer" which has a few of these features and it retails for almost $900. Another company is advertising an accessory automotive computer for $400 but it doesn't include the cruise control function.

Given the cost of a Compucruise and the requirement for installation, is it a useful automotive accessory or is it a toy? Let's explore its installation and application as it relates to my 1973 Cadillac and see.

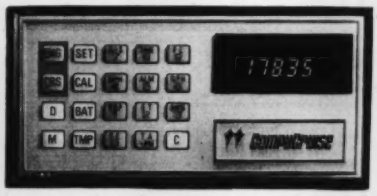


Photo 1. The Compucruise Command Module. The display is deeply recessed to increase daytime readability and the pushbuttons are well lighted for night driving use.

Installation

I have contemplated the installation of an accessory type cruise control on my car for some time. In fact, I recently helped a friend install one in his pickup truck. Therefore, I was familiar with the work required to accomplish such a job. The cruise control portion of the Compucruise installation was very similar, entailing a vacuum servo, pickup coil, drive shaft magnets, and a brake switch. Figure 1 is a diagram of what external devices are interfaced to the Compucruise Command Module.

The vacuum servo is attached to the throttle and it maintains the desired speed in the cruise control mode. Four magnets are mounted on the surface of the drive shaft and they induce pulses in the pickup coil as they rotate past it. The faster the drive shaft turns the quicker the pulses are generated. Compucruise times the intervals between pulses to determine speed and counts them to compute distance.

The brake switch is activated whenever you touch the brake pedal. On cars equipped with manual transmissions, stepping on the clutch will also operate the switch. The cruise control mode is disengaged in either case. This is so that Compucruise won't continue to drive the car while you are trying to stop it.

The flow sensor shown in Figure 1 is

Note 1. Zemco, Incorporated, 1136 Saranap Avenue, Walnut Creek, CA 94595. Compucruise Model 44, without cruise control—$159.95, with cruise control—$199.95.

Rod Hallen, PO Box 73, Tombstone, AZ 85638.

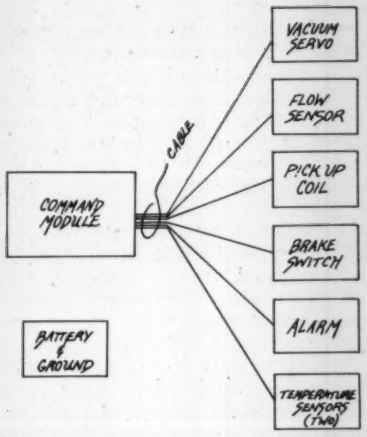


Figure 1. A block diagram of the Compucruise System. All interconnecting wires are color coded and they end in snap-on connectors.

TABLE 1

1. Time of day
2. Elapsed time
3. Stopwatch time
4. Trip driving time
5. Time to arrival
6. Time to empty
7. Wakeup alarm
8. Distance since fillup-miles
9. Distance since fillup-kilometers
10. Trip distance-miles
11. Trip distance-kilometers
12. Distance to arrival-miles
13. Distance to arrival-kilometers
14. Distance to empty-miles
15. Distance to empty-kilometers
16. Fuel used since fillup-gallons
17. Fuel used since fillup-liters
18. Fuel used on trip-gallons
19. Fuel used on trip-liters
20. Fuel to arrival-gallons
21. Fuel to arrival-liters
22. Fuel to empty-gallons
23. Fuel to empty-liters
24. Current speed-MPH
25. Current speed-KPH
26. Average trip speed-MPH
27. Average trip speed-KPH
28. Current fuel consumption—GPH
29. Current fuel consumption-LPH
30. Average fuel consumption-GPH
31. Average fuel consumption—LPH
32. Current fuel efficiency-MPG
33. Current fuel efficiency-LP100K
34. Fuel efficiency for trip-MPG
35. Fuel efficiency for trip-LP100K
36. Inside temperature-degrees Fahrenheit
37. Inside temperature-degrees Celsius
38. Outside temperature-degrees Fahrenheit
39. Outside temperature-degrees Celsius
40. Battery and alternator voltage
41. Cruise control-digitally input speed
42. Cruise control-engage current speed
43. Cruise control-resume last set speed
44. Night time display dimmer

Table 1. This is a complete list of the features available to the Compucruise user. Note that all features can be displayed in English or Metric terms.

inserted in the gas line between the fuel pump and the carburetor. This measures the amount of gas actually being delivered to the engine and is the basis for the computations which result in features 16 to 23 and 28 to 35 in Table 1.

Two temperature sensors are provided with the Compucruise system. They can be placed in any location that you desire. For instance, one under the dash would measure the temperature inside of the car. One taped tightly to a radiator hose would indicate coolant temperature, or placed in a fenderwell or in front of the radiator it would display outside temperature.

The alarm is a small buzzer which is normally put up under the dash. It sounds when an incorrect keyboard entry has been made or when the alarm feature is being used. The only other connections to the Command Module are for battery and ground.

The Command Module must be placed somewhere on or under the dash so that it can be clearly seen and the buttons easily reached by the driver. Photo 2 shows it mounted just to the right of my speedometer. There is normally a switch there that moves the antenna up and down but I never use it. I removed the switch and routed the connecting cable through the hole.

The entire installation took me five and a half hours. Zemco estimates that a skilled mechanic can do it in two hours and a knowledgeable do-it-yourselfer in four. The tools required are common automotive hand tools plus an electric drill and a test light or voltmeter. My time includes note keeping, picture taking and goof redoing time. My biggest mistake was mounting the vacuum servo in such a location that I couldn't put the air cleaner back on. Moving it a few inches took care of that problem. You'll probably be able to better my time if you have any automotive experience at all.

Application

O.K., now I have a computer in my car. What can it do for me? Is it worth the cost, time and energy required to install it?

Of course, a computer-type person might be satisfied just being able to say that his car is computerized but this will not be enough for the average consumer. He will want some return on his investment. This return can be in terms of money saved or in driving enjoyment enhanced.

Compucruise really shines in both of these areas. The "fuel consumption" and "fuel efficiency" displays will not by themselves do anything to save you money but they will make you aware of various means of doing so.

For instance, it has been shown that some brands of gasoline give better mileage than others and they are not the same for all cars. Tire pressure and engine tuning are other areas that affect fuel consumption. Your consumption will begin to increase and your efficiency to decrease when a tuneup is required. A heavy right foot shows up here as reduced fuel efficiency.

Photo 2. The Command Module mounted to the right of my speedometer. It is attached to the underside of the instrument glare shield with one of the brackets provided with the kit. The cable harness exits to the rear.

Compucruise can also help you to prevent costly electrical failures on the highway. Batteries and alternators do not die suddenly. Their demise comes about gradually but most cars don't give you any warning until it's too late. Once you determine what your car's normal readings are, you can more easily detect a slowly deteriorating electrical system.

Keeping track of water temperature on hot days or if the engine is under load, such as when hauling a trailer, is a good idea. The idiot lights provided in most cars are absolutely useless in such situations and a boiling radiator is never any fun. The solution to an overheating problem might be as simple as turning off the air conditioner for a while to reduce the load on the engine.

Running out of gas on the road can also be annoying and sometimes costly. If you were checking the "distance to empty" reading occasionally, it couldn't happen to you! The "fuel to arrival" display would tell you if you had enough gasoline to get where you're going.

I can't even begin to discuss all of the features that Compucruise provides. The clock is accurate and easily readable. I found the elapsed time, stopwatch, and trip driving time functions most useful and they should especially appeal to automobile rally enthusiasts.

The various speed and distance features make driving more interesting and take some of the boredom out of long distance driving for me. "Distance to empty" and "distance to arrival" keep you appraised of your progress. A simple but effective calibration procedure is used to insure the accuracy of the distance and speed displays. I have found that the Compucruise miles per hour reading is much more accurate than my car's mechanical speedometer.

I'm sure that almost everyone is familiar with the purpose that a cruise control serves. You set it for a certain speed and it will hold that speed until it is disengaged. Compucruise allows you to enter the desired speed—say 55 MPH—before you start out and then every time that you touch the "CRS" (CRuise Set) button it will accelerate to and hold that speed. If you want to set a different speed while driving, then you push the "ENG" (engage) button and it will hold whatever speed you are currently traveling.

Whenever the brake (or clutch) is used, the cruise control function is disengaged. If you encounter traffic on the road that you can't pass, you touch the brake and slow down. When the road is clear, push "CRS" and you're back to the same speed as before.

Cruise control was the main reason for my initial interest in the Compucruise system. It maintains my car's speed within one mile per hour of the set speed unless a sudden steep hill is encountered. Speed will then drop three or four miles per hour but it is restored in a few seconds. I suspect that the lag is caused by the operate time of the vacuum servo and not by any deficiency in the Compucruise software or hardware. If your car already has a cruise control, then you can buy Compucruise without it at a reduced price.

I like the Command Module appearance. It is silver faced and attractive. The digital display is bright blue and it can be seen quite clearly in the daytime. A "D" (Dim) pushbutton cuts down on the display brilliance for night driving.

Zemco believes that the Compucruise system will mount in and function on any foreign or domestic vehicle except those equipped with diesel or fuel injected engines. The kit comes with an assortment of parts to fit just about any installation situation. They also provide a 90 day parts replacement warranty.

Conclusion

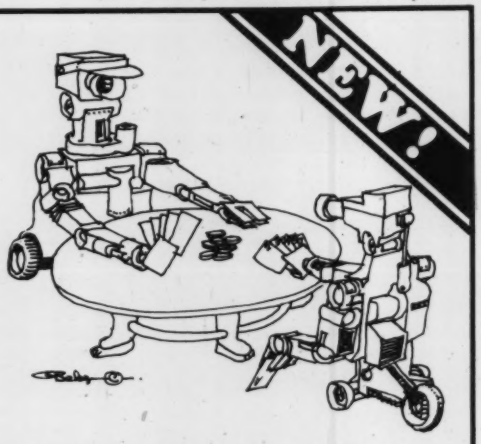
The Command Module is a sealed unit and I'm not sure what kind of ICs it contains, probably some combination of CPU, ROM and RAM. In any case, it is an example of one of the directions that consumer computer products will take.

I have not attempted to go into any detail about the actual installation or operation of the system. Included in the system package are excellent installation and operation manuals which take care of that. Both are well done and they are easily understandable. A checkout and troubleshooting section is designed to help you get it all together. I haven't had any need to use the troubleshooting section so far.

At the beginning I asked the question, "Is it a useful automotive accessory or is it a toy?" It is definitely not a toy. Used properly, it can make your driving more enjoyable, keep you abreast of the condition of your vehicle and its progress on the road, and help save you money.

In the past, the automobile industry installed gauges in cars to give you some idea of what was happening under the hood. Then they decided that idiot lights were better or cheaper or something... Now we seem to be moving in the other direction again. Is the automotive computer the wave of the future? I believe so. To paraphrase a currently popular television commercial, "Someday all motor vehicles will be equipped this way!" ■

More Basic Computer Games



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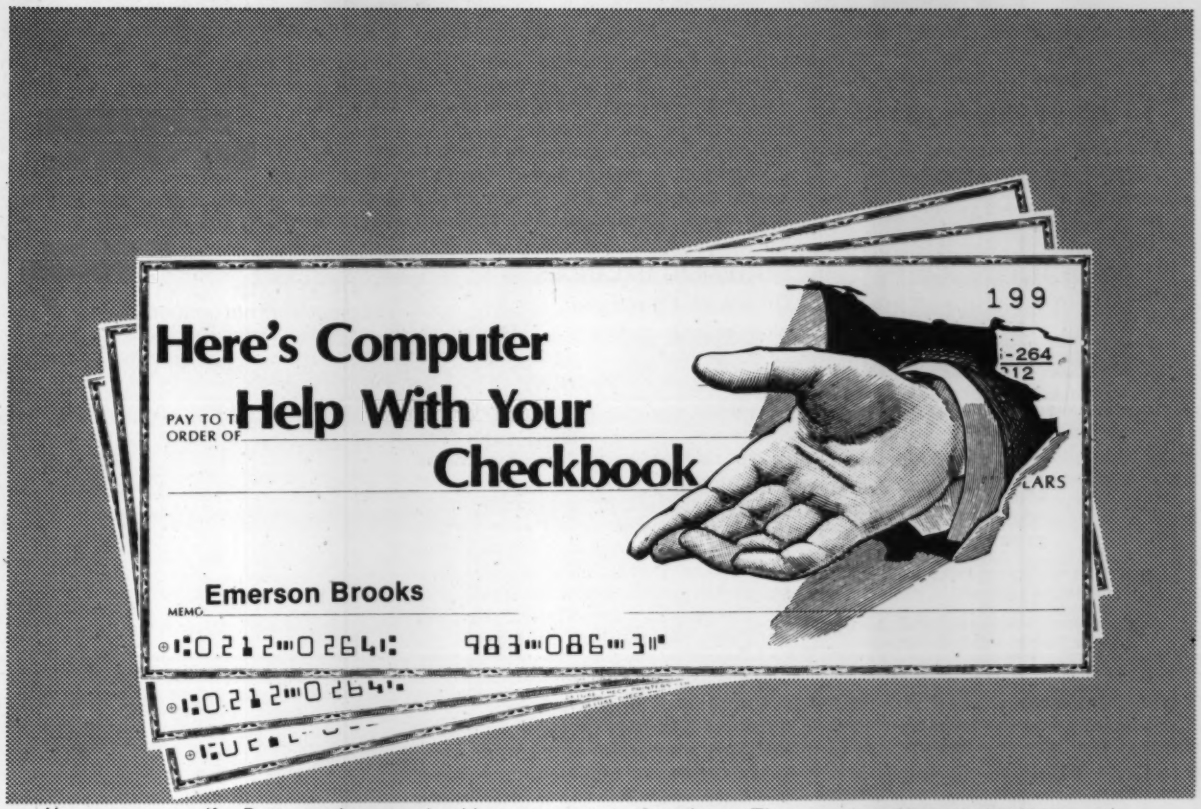

Years ago my wife, Betty, took over writing all those checks which must be written each month. However, doing arithmetic is not one of her strong points, and since this was before the time of pocket calculators, I got the task of reconciling the checkbook. Years later and still not appreciating mathematics, Betty has a low regard for my home computer, especially since I spend so much time working with it. With this background you can see why I was interested when Editor John Craig asked if I would review Computer Software Services' Disk Check File Maintenance System. Maybe I could save myself some time and effort in checkbook reconciling, raise my computer's standing with my wife, and perhaps even get her to learn to operate it.

Computerware Software Services is a three-year-old company located near San Diego, California, specializing in software and system hardware using the Motorola 6800 microprocessor. They market a wide variety of recreational and business software, including a very capable extended BASIC interpreter.

The purpose of the Check File Maintenance System is to aid you in keeping your checking account records. This is accomplished by setting up and maintaining a file on a disk which contains all of the appropriate information about your checking account transactions. The system contains programs for creating the file, adding to the file, making corrections, updating status, reconciling to the bank statement, and printing out information from the file. These programs take the user through a step-by-step procedure to accomplish the functions in an organized manner.

After the Disk Operating System has been brought up and BASIC loaded the Check File System is started by typing CHAIN MENU. You are then presented with 10 functions as follows:

```
CHECKING ACCOUNT PROGRAMS

 1—CREATE CHECK FILE.
 2—PRINT OUT FILE.
 3—PRINT TAX CODES.
 4—UPDATE RETURNED CHECKS.
 5—RECONCILE BANK
    STATEMENT.
 6—CHANGE DATA ON FILE..
 7—ADD TO CHECK FILE.
 8—COPY FILE (PROTECT DATA).
 9—INSERT OR DELETE RECORDS.
10—DISK OPERATING SYSTEM.

TYPE IN NUMBER OF SELECTION.
```

The system operates using two files, CHECK.1 and CHECK.2, reading from one and writing to the other. Each time a new operation is started the oldest file is scratched and rewritten. The name of the latest (CURRENT) file is kept in a separate file called NAME.

The create function (1) is used to set up the first check file, starting with the beginning balance. Each check or transaction is entered, aided by prompting from the program. The program then presents the information for verification, as this example shows:

```
CHECK NUMBER 5230
DATE         1 13 79
WRITTEN TO   SEARS ROEBUCK
AMOUNT       103.57
TAX CODE     49
RETURNED     N
BALANCE      1423.68
```

The program computes the new balance. In a similar manner deposits and other transactions such as bank automatic payments are entered. The tax code entry is provided to enable you to classify your checks into different categories for tax or budget or other purposes.

The current check file may be added to (7), have errors corrected (6), have records inserted or deleted (9), be printed out starting at a designated check number (2), or be printed out and totaled by category (3), or may be copied to another back-up file for safety (8).

When it is time to reconcile your account, you simply sort your checks into numerical order and update the returned check indicators in the check file using (4). The program presents the

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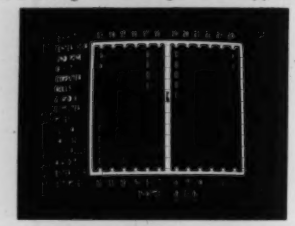

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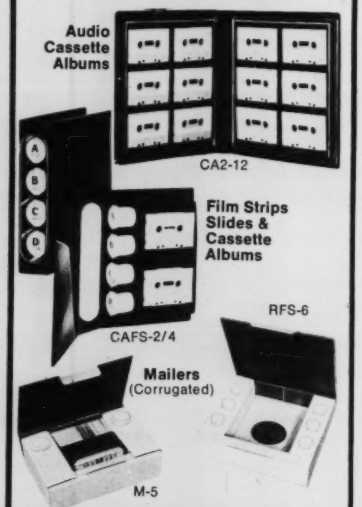

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listing of each unreturned check in the check file, in listing order, and asks if it has been returned (Y/N). After updating for returned checks, you go to the reconcile bank statement function (5) and follow the prompts presented by the program. If you (or the bank) have made no mistakes the program will end with the message

STATEMENT BALANCES.

Otherwise it gives you

STATEMENT DOES
—NOT—
BALANCE. ERROR-ERROR

At this point you are on your own to find the error. However you do have the neatly printed listing of the check file with which to work while looking for the error, *and* you know the error is not in your arithmetic.

After completing any function the program returns to MENU so you may select the next function. Function (10) returns you to the Disk Operating System. In addition to providing prompts for each step, the program lets you choose the output format to suit your printer, the print output port and other operational aspects which make the program flexible and easy to use.

The Check File Maintenance System is written in BASIC and is intended to be used with the BASIC interpreter CSS has written for the Smoke Signal DOS68 Disk Operating System, running on a SWTPC or Smoke Signal 6800 computer. There are many versions of CSS BASIC and DOS68. The instruction manual illustrates operation with CSS BASIC version BFD-3.3 and Smoke Signal DOS68 V2.7. However both of these companies obviously recognize the importance of upward compatibility because the Check File Maintenance System will run on later versions. My system has available either DOS68 V3.1 with sequential files or DOS68 V4.2 with random and sequential files. Available CSS BASIC is either version 4.1 or 7.0. The Check File System will run with any combination of these, so it is probably safe to assume it will run with any CSS BASIC later than 3.3 or DOS68 later than 2.7.

The Check File System is made up of 11 BASIC programs and four data files. The manual contains listings for nine of these programs. However the listings in the manual *are not the same* versions as the listings of the programs provided on the disk. The manual has not been updated to the latest program versions, but this is no problem because you can always produce a listing from the BASIC program in case you want to "customize" it for your system. The programs are written by Jack A. Inman and are well documented and easy to follow. Considerable use is made of some commands available in CSS BASIC which may not be available in other less capable BASIC interpreters. In particular, the CHAIN command, which loads a program from the disk and starts it executing, is used to tie together the 11 programs making up the system.

The Check File System must reside on DRIVE 0 for operation. The disk supplied does not contain DOS68.27 as the manual indicates. I would suggest that you copy your version of DOS68 and CSS BASIC onto the disk containing the Check File System for convenience in operation.

The manual recommends that you keep your CHECK data files on a separate disk so there will be plenty of room for your check files. This is no problem in a two or three drive system. In a one drive system you have to frequently shift back and forth between the program disk and the check file disk, prompted by instructions from the program. If you use DOS68 V4.2 on a single drive system you will need to copy the non-resident function files DFM680.341, DFM680.342, and DFM680.343 onto the check file disk because these are used by the BASIC interpreter for writing to disks.

My check file now contains 145 transactions, and occupies 64 sectors on the disk. At this rate a disk can hold 711 transactions, more than I have in a year.

There is a twelfth program on the disk named CONVER.T which is not mentioned in the instruction manual nor is it used in any of the functions. My guess is that CSS has some plans for future expansion of the check program.

A nice added feature would be to have the computer actually type the checks from the information entered.

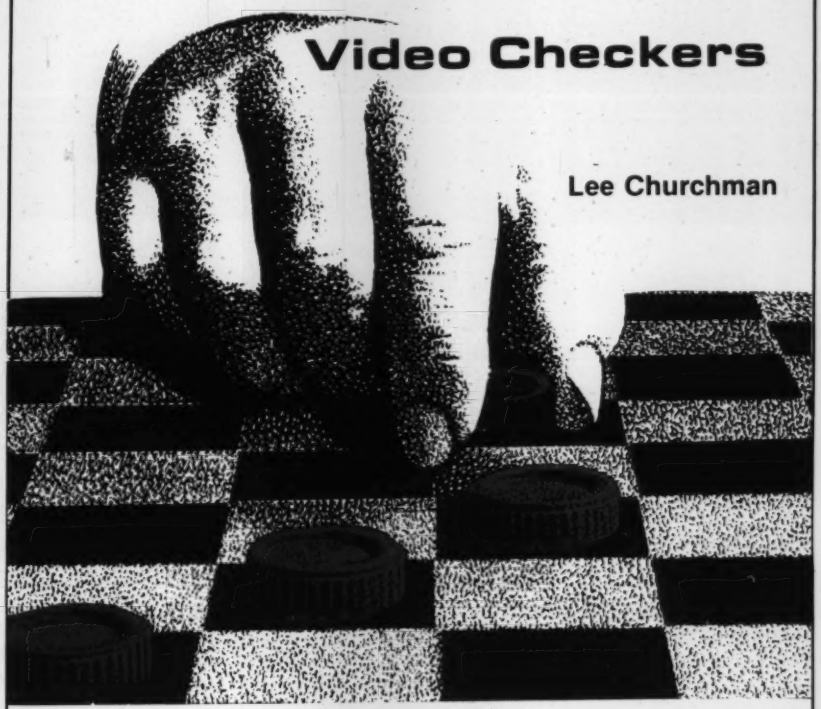
In summary, the Disk Check File Maintenance System is a well thought out and well executed system. The program ran on the first attempt, and did the job for which it is intended. It is easy to use, prompting the user at each step. The instruction book is detailed and complete, but not up to date. Because the program is in BASIC, the user may easily make minor modifications to suit his particular system hardware or use.

The Disk File Maintenance System is available from Computerware Software Services, 830 First Street, Encinitas, California, 92024. The published price is $49.95, including diskette and delivery.

And what about my hopes for the program? The last word was said when Betty commented, "Do you mean you have to do all that just to balance the checkbook?" ■

Video Checkers

Lee Churchman



Video Checkers, by Compu-Quote, is an interesting, if not brilliant game. Unfortunately, the negatives seem to outweigh the positives when considering the desirability of this version of checkers.

It does seem to play a perfectly legal game, as claimed. The numbering of the board is standard for tournament checkers, a definite plus. Board and piece positions are continuously displayed, though this is something we have come to expect. Moves are easily made, and the program responds with its move in a reasonable time.

However, there are some drawbacks. The squares are numbered so that the number takes up part of the playing square, and little room is left for a graphic representation of the piece. Also, kings are identified by a letter K in the southeast corner of the square, thus cluttering up the board even more, so that it is difficult to see the board as a whole, and get any "feel" for the relationships between pieces. The PET graphics could have been used to much better advantage.

Also, as Compu-Quote says, the program does not play a strategically "clever" game. A fully legal game, yes, but clever, no. Compu-Quote says, "It can be beaten by any but the most amateurish player", and I believe it. I found no challenge in beating the program; in fact, I found the only challenge in trying to accumulate ten kings before the computer could manage to lose all its pieces. This is a difficult challenge. The best I have done so far is five kings and five pieces in position to be crowned, but each time the program has moved its last piece out in front of one of mine so that I couldn't avoid taking it, thus ending the game before the coronation ceremonies were completed. I'm sure it can be done, though.

Lee Churchman, 227 W. Cook St., Santa Maria, CA 93454.

Video Checkers is available on cassette for the TRS-80 and PET from Comput-Quote, 6914 Berquist Ave., Canoga Park, CA 91307. $14.95.

Response from Compu-Quote:

At the recent Computer Faire held in Los Angeles, we at COMPU-QUOTE were delighted with the response to our Video Checkers program on display in our booth. Youngsters especially seemed intrigued in playing and were beaten by our computer more often than not. While true that an accomplished player (such as the reviewer) may not be adequately challenged, the beginner will be stimulated to improve his or her game. We also feel that the PET or TRS-80 owner interested in learning more about graphics will benefit by studying the algorithms that make up our program.

Marvin Mallon
Compu-Quote

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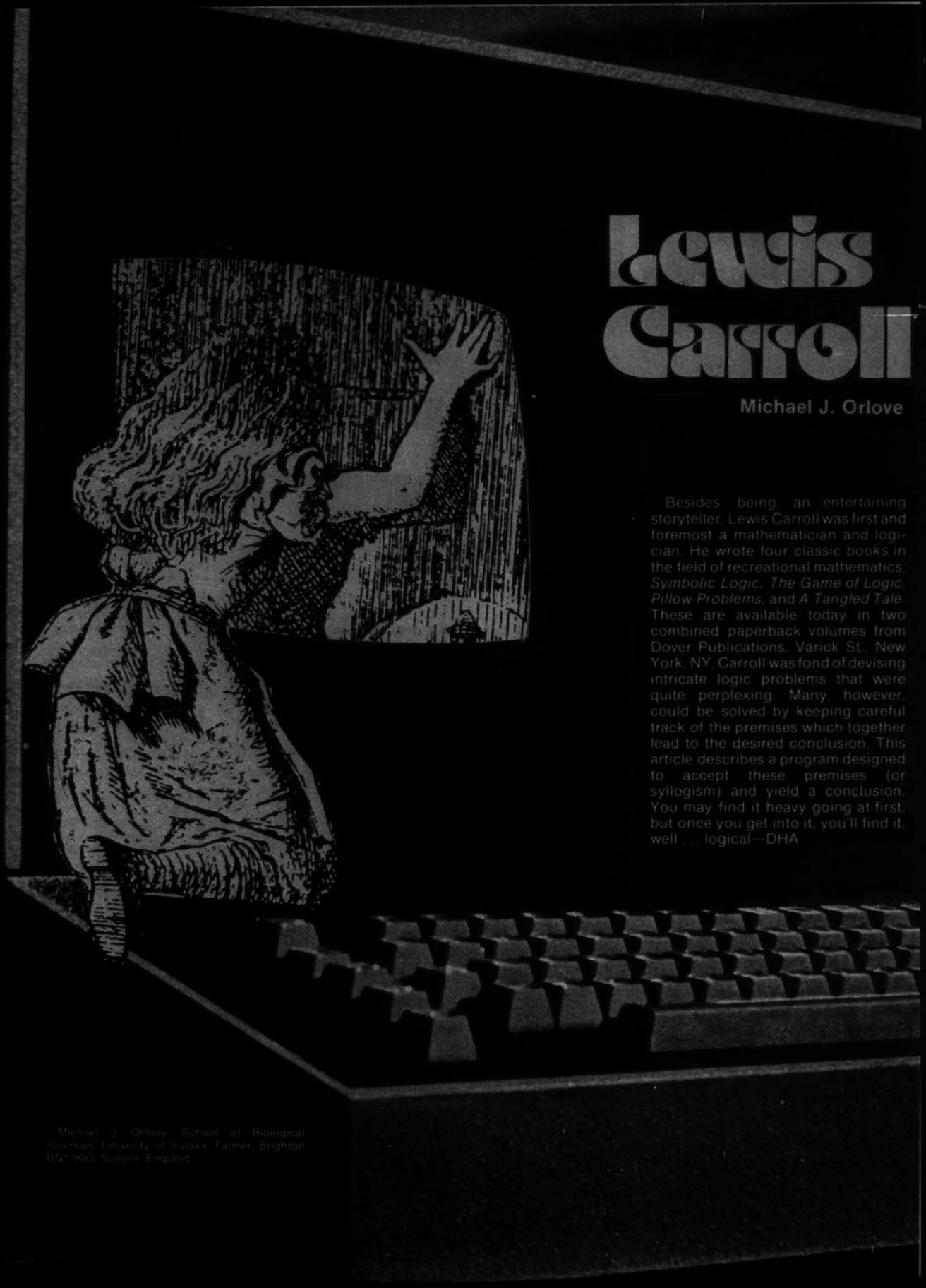

Lewis Carroll

Michael J. Orlove

Besides being an entertaining storyteller, Lewis Carroll was first and foremost a mathematician and logician. He wrote four classic books in the field of recreational mathematics, *Symbolic Logic*, *The Game of Logic*, *Pillow Problems*, and *A Tangled Tale*. These are available today in two combined paperback volumes from Dover Publications, Varick St., New York, NY. Carroll was fond of devising intricate logic problems that were quite perplexing. Many, however, could be solved by keeping careful track of the premises which together lead to the desired conclusion. This article describes a program designed to accept these premises (or syllogism) and yield a conclusion. You may find it heavy going at first, but once you get into it, you'll find it, well . . . logical—DHA

Michael J. Orlove, School of Biological Sciences, University of Sussex, Falmer, Brighton BN1 9QG, Sussex, England

Introduction

This name is given to a computer program which solves problems in Logic posed by the 19th century mathematician of the same name. His real name was Rev. Charles Ludwidge Dodgson, but when he authored *Alice's Adventures In Wonderland* he adopted the pseudonym. The computer program is a mini-system. The programs which it runs are syllogisms you type in. A syllogism is a group of sentences called "premises" which imply or silently assert an unstated sentence called a "conclusion." For example: I am human. Humans are bigger than mice. Therefore I am bigger than a mouse. The premises occur before the "therefore" and the conclusions after (to the right of) the "therefore."

The system has five functions:

1. Facility to read in syllogisms.
2. Facility to find a conclusion when given premises, or to replace a user-supplied conclusion with the one Lewis Carroll would have supplied.
3. Facility to supply your conclusion and ask the computer the yes-or-no question, "Is it valid?" Since many syllogisms have several interesting conclusions, this facility is instructive. (It can be very slow on long syllogisms, so it is recommended that facility 2 only be used on longer ones.)
4. Facility to "edit" (i.e., modify) the syllogism quickly and easily.

Limitations of the Program

Program Lewis Carroll is limited to the use of bilateral premises as opposed to multi-lateral premises. Every time a premise is stated, another unspoken sentence (called its contrapositive) is implied. Thus "dogs are mammals" implies its contrapositive, "non-mammals are non-dogs," or as you must write for the program, "Not Mammals are Not Dogs."

Lewis Carroll tried to persuade the logicians of his time to think of "are not dogs" as made up of:

Are	Not Dogs
Verb	*Noun*

instead of:

Are not	Dogs
Verb	*Noun*

Thus "not mammals" is a valid beginning for a sentence. Consider the premise "Big Brown Bears are Alaskans." Every time you type in a premise the computer must "type in" its contrapositive internally. Interpreted as a bilateral premise the above would have one contrapositive, namely, "Not Alaskans are not (big brown bears)." Interpreted as a multilateral premise, at least 3 contrapositives result, namely:

1. "Big Brown Not Alaskans are Not Bears."
2. "Big Not Alaskan Bears are Not Brown."
3. "Not Alaskan Brown Bears are Not Big."

You can also get:

4. "Not Alaskan Bears are Not Big Not Brown."

This program does not supply multilateral interpretation and "Big Brown Bears" must be typed on one line and is treated like one name.

Using the Program

The best way to familiarize oneself with "Lewis Carroll" is to type in the given examples. The verb, to be, is redundant: "A bee is an insect, a hive is a house," can be abbreviated: "a bee an insect, a hive a house." As the computer doesn't want to interpret "a hive" as "a is hive," type in as follows:

?A HIVE	instead of:	?A
?A HOUSE		?HIVE
		?A
		?HOUSE

All occurrences of is, are, and not must have a line to themselves. All syllogisms are to be terminated with "OK" on a line to itself. To stop the machine from adding whatever you write to a syllogism type "OK" to terminate the syllogism. "Quit" terminates the program, but will not terminate a syllogism. When using the "Edit" facility type a minus sign "-" to leave the line unchanged, "delete" to delete the line and anything else to replace the line.

```
Not?-
Pihs? delete
Pigs?-

Fubby? Funny
OK?-
```

To get "not pigs are funny."

Since the order of premises in a syllogism does not alter the conclusions no "insert" facility is supplied (the program has to fit into a microcomputer).

Endless Loops—Oops!

Lewis Carroll has its own facility to escape endless loops. The premises "Pigs are Hogs—Hogs are Pigs" would otherwise tie up the machine forever.

The user should therefore never attempt to remove seemingly useless statements from the program which add 1,000 to variables and then take the remainder after division by 1,000. These statements help the machine recognize and exit from loops. Such loops are created when declaring opposites. Thus "hot is not cold" and "not hot is cold" declare these two opposites. One of the two will put the syllogism in a loop, the other leads it to Lewis Carroll's conclusion. The machine finds out which it needs by trying one and if it gets in a loop it jumps out and tries the other. The "one two two three" problem in the examples shows how the program can escape from loops only to find itself in another loop but it escapes that too, eventually finding the conclusion.

The Empty Set and the Universe: The Krakens and Dragons Problem

The empty set is that set or class which contains no members. The universal set is the set which includes everything. The premise "x are not x" is not a contradiction. It is a declaration that x is a name for the empty set. Similarly "not y are y" declares "y" a name for the universal set. This is because the empty set is a subset of all sets even its opposite (or complement) which is "not the empty set." Similarly all sets are subsets of the Universal set even "not the Universal set." So from "Phi are not Phi" or "a not U are U" we get:

1. Phi and U are complements i.e., Phi are Not U and Not Phi are U.
2. Phi are Pigs
3. Bees are U.

We can now prove by a counter-intuitive process which is valid that Krakens are Dragons. To do this we need only show that Krakens are in a subset of the empty set. This is done by showing they are in the set "mythical" and its complement at the same time. (See final example.) Krakens were thought to be purely mythical little fish—or squid-like giant animals. The rediscovery of giant squids in the 1870's dispelled the myth aspect, but the word "Kraken" is sometimes reserved only for the legendary creature.

The Use of Non Sequiturs

The mention of names in the conclusion which are not mentioned in the premises result in invalid syllogisms, except:

1. When the empty set is said to be a subset of another set as in the Krakens and Dragons puzzle.
2. The conclusion is a tautology (i.e., intrinsically true, e.g., "pigs are pigs").
3. Two premises contradict (e.g., "not x are x" and "x are not x").

```
RUN
                    LEWIS CARROLL
          CREATIVE COMPUTING  MORRISTOWN, NEW JERSEY


TYPE IN A SYLLOGISM, THEN TYPE OK
  ? PIGS
  ? ARE
  ? NOT
  ? PIGS
  ? -
  ? THEREFORE
  ? IT
  ? IS
  ? RAINING
  ? .
  ? OK

OPTIONS = INFER,IS IT VALID?,EDIT,READ,DUMP,REPLACE,QUIT,SAVE
TYPE ONE IN
? IS IT VALID?
IS IT VALID?

NO

OPTIONS = INFER,IS IT VALID?,EDIT,READ,DUMP,REPLACE,QUIT,SAVE
TYPE ONE IN
? READ
READ
TYPE IN A SYLLOGISM, THEN TYPE OK
  ? IT
  ? IS
  ? SNOWING
  ? THEREFORE
  ? PIGS
  ? ARE
  ? PIGS
  ? .
  ? OK

OPTIONS = INFER,IS IT VALID?,EDIT,READ,DUMP,REPLACE,QUIT,SAVE
TYPE ONE IN
? IS IT VALID?
IS IT VALID?

YES

OPTIONS = INFER,IS IT VALID?,EDIT,READ,DUMP,REPLACE,QUIT,SAVE
TYPE ONE IN
? READ
READ
TYPE IN A SYLLOGISM, THEN TYPE OK
  ? BEES
  ? ARE
  ? INSECTS
  ? THEREFORE
  ? IT
  ? IS
  ? SUNNY
  ? .
  ? OK

OPTIONS = INFER,IS IT VALID?,EDIT,READ,DUMP,REPLACE,QUIT,SAVE
TYPE ONE IN
? IS IT VALID?
IS IT VALID?

NO

OPTIONS = INFER,IS IT VALID?,EDIT,READ,DUMP,REPLACE,QUIT,SAVE
TYPE ONE IN
? READ
READ
TYPE IN A SYLLOGISM, THEN TYPE OK
  ? NOT
  ? Q
  ? ARE
  ? NOT
  ? P
  ? OK

OPTIONS = INFER,IS IT VALID?,EDIT,READ,DUMP,REPLACE,QUIT,SAVE
TYPE ONE IN
? INFER
INFER

 THEREFORE   P ARE   Q .
OPTIONS = INFER,IS IT VALID?,EDIT,READ,DUMP,REPLACE,QUIT,SAVE
TYPE ONE IN
? IS IT VALID?
IS IT VALID?

YES
```

```
TYPE IN A SYLLOGISM, THEN TYPE OK
  ? PHI
  ? ARE
  ? NOT
  ? PHI
  ? -
  ? NOT
  ? U
  ? ARE
  ? U
  ? THEREFORE
  ? PHI
  ? ARE
  ? NOT
  ? U
  ? -
  ? NOT
  ? PHI
  ? ARE
  ? U
  ? -
  ? BEES
  ? ARE
  ? U
  ? -
  ? PHI
  ? ARE
  ? PIGS
  ? .
  ? OK
```

```
OPTIONS = INFER,IS IT VALID?,EDIT,READ,DUMP,REPLACE,QUIT,SAVE
TYPE ONE IN
? IS IT VALID?
IS IT VALID?

YES

OPTIONS = INFER,IS IT VALID?,EDIT,READ,DUMP,REPLACE,QUIT,SAVE
TYPE ONE IN
? REPLACE
REPLACE
INPUT WRONG SPELLING,RIGHT SPELLING,MODE OF REPLACE (GLOBAL,LOCAL)
? U,THE UNIVERSE,GLOBAL
U             THE UNIVERSE  GLOBAL

OPTIONS = INFER,IS IT VALID?,EDIT,READ,DUMP,REPLACE,QUIT,SAVE
TYPE ONE IN
? REPLACE
REPLACE
INPUT WRONG SPELLING,RIGHT SPELLING,MODE OF REPLACE (GLOBAL,LOCAL)
?'PHI,THE EMPTY SET,GLOBAL
PHI           THE EMPTY SET GLOBAL

OPTIONS = INFER,IS IT VALID?,EDIT,READ,DUMP,REPLACE,QUIT,SAVE
TYPE ONE IN
? PRINT
PRINT
   THE EMPTY SET ARE NOT THE EMPTY SET   NOT THE UNIVERSE ARE THE UNIVER
SE BOUNDARIE THE EMPTY SET ARE NOT THE UNIVERSE   NOT THE EMPTY SET ARE
THE UNIVERSE   BEES ARE THE UNIVERSE   THE EMPTY SET ARE PIGS BOUNDARIE
OPTIONS = INFER,IS IT VALID?,EDIT,READ,DUMP,REPLACE,QUIT,SAVE
TYPE ONE IN
? READ
READ
TYPE IN A SYLLOGISM, THEN TYPE OK
  ? KRAKENS
  ? ARE
  ? MONSTERS
  ? -
  ? MONSTERS
  ? ARE
  ? MYTHICAL
  ? -
  ? KRAKENS
  ? ARE
  ? SQUIDS
  ? -
  ? SQUIDS
  ? ARE
  ? NOT
  ? MYTHICAL
  ? THEREFORE
  ? KRAKENS
  ? ARE
  ? DRAGONS
  ? .
  ? OK
```

```
OPTIONS = INFER,IS IT VALID?,EDIT,READ,DUMP,REPLACE,QUIT,SAVE
TYPE ONE IN
? IS IT VALID?
IS IT VALID?

YES
```

```
10   PRINT TAB(30);"LEWIS CARROLL"
20   PRINT TAB(15);"CREATIVE COMPUTING  MORRISTOWN, NEW JERSEY"
30   PRINT:PRINT:PRINT
40   CLEAR 2000: REM SETS BYTES OF STRING SPACE
50    DIM Q$(2), M$(28), F(57), B(57)
60   DIM V$(100), N(93)
70   FOR I=2 TO 100
80   V$(I) = " "
90   NEXT I
100  V$(1) = " "
110  I=1
120  H0 = 2
130  Q$(1) = " "
140  Q$(2) = "NOT"
150  PRINT "TYPE IN A SYLLOGISM, THEN TYPE OK"
160  I = I+1
170  PRINT V$(I);
180  PRINT " ";
190  INPUT A$
200  REM
210  IF A$="-" THEN 230
220  V$(I)=A$
230  09 = I+1
240  IF V$(I) = "OK" THEN 850
250  IF V$(I) = "." THEN 290
260  IF V$(I) = "THEREFORE" THEN 290
270  IF V$(I) = "DELETE" THEN 2490
280  GOTO 160
290  V$(I) = "BOUNDARIE"
300  GOTO 160
310  N3 = 0
320  PRINT
330  GOSUB 1440
340  FOR H = 1 TO N3
350  F(H) = 0
360  NEXT H
370  P9 = 1
380  Y = 1
390  GOSUB 510
400  F(Y) = F(Y) + 1
410  IF F(Y) < 2 THEN 380
420  F(Y) = 0
430  Y = Y+1
440  IF Y < (N3+1) THEN 400
450  IF P9=1 THEN 770
460  IF P9=0 THEN 790
470  STOP
480  REM BACKSPACE 1
490  REM DATA LOAD V$()
500  GOTO 310
510  GOSUB 580
520  P1 = P
530  P = 1
540  GOSUB 600
550  P2 = P
560  P9 = P9*(P1*P2-P1+1)
570  RETURN
580  I = 0
590  P = 1
600  I = I+1
610  IF V$(I) = "BOUNDARIE" THEN 760
620  IF N(I)=0 THEN 600
630  J = I
640  J = J+1
650  IF V$(J)="BOUNDARIE" THEN 760
660  IF N(J)=0 THEN 640
670  N1 = 0
680  N2 = 0
690  IF V$(I-1)="NOT" THEN 810
700  IF V$(J-1)="NOT" THEN 830
710  Q1 = ABS(N1-F(N(I)))
720  Q2 = ABS(N2-F(N(J)))
730  P = P*(Q1+Q2-Q1+1)
740  I = J
750  GOTO 600
760  RETURN
770  PRINT "YES"
780  GOTO 850
790  PRINT "NO"
800  GOTO 850
810  N1 = 1
820  GOTO 700
830  N2 = 1
840  GOTO 710
850  PRINT
860  PRINT "OPTIONS = INFER,IS IT VALID?,EDIT,READ,DUMP,";
870  PRINT "REPLACE,QUIT,SAVE"
880  PRINT "TYPE ONE IN"
890  INPUT A$
900  PRINT A$
910  IF A$="IS IT VALID?" THEN 310
920  IF A$="INFER" THEN 1270
930  IF A$="EDIT" THEN 100
940  IF A$="READ" THEN 70
950  IF A$="DUMP" THEN 2390
960  IF A$="PRINT" THEN 1000
970  IF A$="SAVE" THEN 1090
980  IF A$="REPLACE" THEN 1140
990  IF A$="QUIT" THEN 1260
1000 I = 0
1010 V$(09)="THEREFORE"
1020 V$(09+6) = "."
1030 I = I+1
1040 PRINT " ";
1050 PRINT V$(I);
1060 IF V$(I+1)="OK" THEN 2360
1070 GOTO 1030
1080 REM BACKSPACE 1
1090 PRINT "THIS FACILITY IS MACHINE DEPENDENT"
1100 PRINT "YOU MUST PROVIDE IT YOURSELF."
1110 GOTO 850
1120 REM DATA SAVE V$()
1130 GOTO 310
1140 PRINT "INPUT WRONG SPELLING,RIGHT SPELLING,";
1150 PRINT "MODE OF REPLACE (GLOBAL,LOCAL)"
1160 INPUT A$, B$, C$
1170 PRINT A$, B$, C$
1180 I = 0
1190 I = I+1
1200 IF V$(I)=A$ THEN 1220
1210 GOTO 1240
1220 V$(I) = B$
1230 IF C$="LOCAL" THEN 850
1240 IF V$(I)="OK" THEN 850
1250 GOTO 1190
1260 STOP
1270 N3 = 0
1280 PRINT
1290 B0 = 0
1300 V$(09) = "OK"
1310 FOR I = 1 TO 57
1320 F(I) = 0
1330 B(I) = 0
1340 NEXT I
1350 I = 0
1360 I = I+1
1370 IF V$(I)="OK" THEN 1400
1380 IF V$(I)<>"BOUNDARIE" THEN 1360
1390 V$(I) = "OK"
1400 H9 = 1
1410 IF H0>2 THEN 1730
1420 GOSUB 1440
1430 GOTO 1650
1440 H0=2
1450 I = 0
1460 I = I+1
1470 N(I) = 0
1480 IF V$(I)="OK" THEN 1630
1490 IF V$(I)="NOT" THEN 1460
1500 IF V$(I)="BE" THEN 1460
1510 IF V$(I)="IS" THEN 1460
1520 IF V$(I)="ARE" THEN 1460
1530 IF V$(I)="BOUNDARIE" THEN 1460
1540 J = 0
1550 J = J+1
1560 IF V$(J)=V$(I) THEN1610
1570 IF J<(I-1) THEN 1550
1580 N3 = N3+1
1590 N(I) = N3
1600 GOTO 1460
1610 N(I) = N(J)
1620 GOTO 1460
1630 I = 0
1640 RETURN
1650 I = I+1
1660 IF V$(I)="OK" THEN 1730
1670 IF N(I)=0 THEN 1650
1680 N(I) = N(I)*2
1690 IF V$(I-1)<>"NOT" THEN 1710
1700 N(I) = N(I)+1
1710 M$(N(I)/2) = V$(I)
1720 GOTO 1650
1730 I = 0
1740 I = I+1
1750 09 = I
1760 IF V$(I)="OK" THEN 2070
1770 IF N(I)=0 THEN 1740
1780 J = I
1790 J = J+1
1800 IF V$(J)<>"OK" THEN 1850
1810 PRINT"ERROR- THE SENTENCE WHOSE SUBJECT IS "
1820 PRINT V$(I);
1830 PRINT" HAS NO OBJECT."
1840 GOTO 850
1850 REM
1860 IF N(J)=0 THEN 1790
1870 P = N(I)
1880 Q = N(J)
1890 FOR Z=1 TO 2
1900 IF B0=0 THEN 1920
1910 IF F(P)<2000 THEN 1930
1920 F(P) = Q
1930 IF B0=0 THEN 1950
1940 IF B(Q)<2000 THEN 1960
1950 B(Q) = P
1960 REM
1970 R = P
1980 P = Q
1990 Q = R
2000 K = P-INT(P/2)*2
2010 L = Q-INT(Q/2)*2
2020 P = INT(P/2)*2 + (1-K)
2030 Q = INT(Q/2)*2 + (1-L)
2040 NEXT Z
2050 I = J
2060 GOTO 1740
2070 H9=H0
2080 B0=1
2090 I = H9
2100 Q = I
2110 IF F(I)=0 THEN 2160
2120 IF F(I)>2000 THEN 1730
2130 F(I) = F(I)+1000
2140 I = F(I)-INT(F(I)/1000)*1000
2150 GOTO 2100
2160 I = H9
2170 P = I
2180 IF B(I)=0 THEN 2230
2190 IF B(I)>2000 THEN 1730
2200 B(I) = B(I)+1000
2210 I = B(I)-INT(B(I)/1000)*1000
2220 GOTO 2170
2230 REM
2240 A1 = P-INT(P/2)*2
2250 A2 = Q-INT(Q/2)*2
2260 V$(09) = "BOUNDARIE"
2270 V$(09+1) = Q$(A1+1)
2280 V$(09+2) = M$(P/2)
2290 V$(09+3) = "ARE"
2300 V$(09+4) = Q$(A2+1)
2310 V$(09+5)=M$(Q/2)
2320 V$(09+6) = "BOUNDARIE"
2330 V$(09+7) = "OK"
2340 I=09-1
2350 GOTO 1010
2360 V$(09) = "BOUNDARIE"
2370 V$(09+6) = "BOUNDARIE"
2380 GOTO 850
2390 FOR I = 1 TO 28
2400 PRINT " ";
2410 PRINT I;
2420 PRINT "-";
2430 PRINT M$(I);
2440 NEXT I
2450 INPUT H0
2460 PRINT H0
2470 H0 = H0*2
2480 GOTO 1270
2490 J=I-1
2500 J=J+1
2510 V$(J)=V$(J+1)
2520 IF V$(J)<> "OK" THEN 2500
2530 GOTO 170
2540 END
```

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YAWN
MYTH
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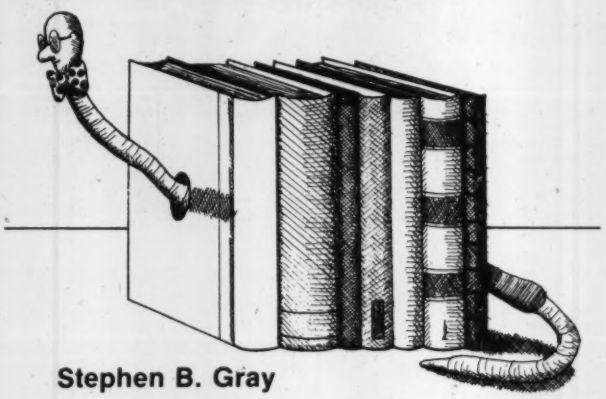
Reviews



Stephen B. Gray

Microcomputer Primer, by Mitchell Waite and Michael Pardee. Howard W. Sams & Co., Inc., Indianapolis, IN 46268. 224 pges, paperback $7.95. 1976.

Although the emphasis is more on commercial computers than on personal computers (the photo on the cover is of a Pro-Log commercial EPROM programmer), this book does give the hobbyist with a knowledge of basic electronics a good background in just what a microcomputer is and how it works.

After a brief introduction, the book discusses the main parts of a computer: CPU, memory, input/output, and programs. Numbering systems are covered in an appendix.

The hardware section discusses such MPUs as the 8080, 6800, 6502, SC/MP and LSI-11, not in great detail but enough to provide a good idea of how they work. The programming chapter, in describing the writing of a MOVE program for the 6800, does an excellent job of telling what assembly language is all about.

Curiously, high-level languages are not mentioned at all; there is not one word about BASIC, FORTRAN or even JOSS. Nevertheless, Waite and Pardee have written a very good book on the basics of micros and assembler.

○ ○ ○

A Step By Step Introduction to 8080 Microprocessor Systems, by David L. Cohn and James L. Melsa, Dilithium Press, Box 92, Forest Grove, OR 97116. 181 pages, paperback $7.95. 1977.

According to the preface, "This microprocessor book is written for people who don't know anything about microprocessors but who wish they did. The step-by-step presentation does not require any computer or electronic background."

Yet, after a brief introduction, the second chapter, on Basic Machine Structure, describes a "simple microcomputer" in only two pages, and within only a few pages more, presents a sample program. This is a little too fast for the average person who wishes to learn something about microprocessors. The pace doesn't slow down, either; by page 16 the authors have introduced four more registers and gone headlong into MOVe instructions. The remaining chapters are on stored programs, jump instructions, system monitors, input/output, assemblers, stacks, interrupts, etc.

The book is chockful of information, presented thoroughly but at a pace too fast for the average user of, say, a TRS-80 or Apple computer. It's more for the electronically-minded or mathematically-oriented person who's just getting into bit-hacking and who has a real thirst for learning all he can about microprocessors. For him or her, this is a fine book.

For others, a suggestion: look for this book at your

neighborhood computer store and read pages 5 through 8. If you can understand them in one or two readings and want to know more, buy it.

○ ○ ○

Z80 Programming for Logic Design, by Adam Osborne, Jerry Kane, Russell Rector, and Susanna Jacobson. Osborne & Associates, Inc., Berkeley, CA. 352 pages, paperback $8.50. 1978.

According to the introduction, "This book explains how an assembly language program within a microcomputer system can replace combinatorial logic—that is, the combined use of "off-the-shelf," non-programmable logic devices such as standard 7400 series digital logic.

"If you are a logic designer, this book will teach you how to do your old job in a new way—by creating assembly language programs within a microcomputer system. If you are a programmer, this book will show you how programming has found a new purpose—in logic design."

After a chapter on assembly language and digital logic, the authors show how to simulate the logic for a Qume printer interface, present a program to do this, examine programming (subroutines, macros, interrupts) and the Z80 instruction set, and provide some commonly-used subroutines.

This outstanding example of how such a book should be written packs a great deal of information into a small paperback that will obviously have a limited audience. Its outstanding features are that it goes into great detail, and in simple language. The book assumes only that you have read, or otherwise understand, the material covered in another Osborne book, "An Introduction to Microcomputers," which is now a three-volume set.

○ ○ ○

The BASIC Handbook: An Encyclopedia of the BASIC Computer Language, by David A. Lien. CompuSoft Publishing, P.O. Box 19669, San Diego, CA 92119. 360 pages, paperback $14.95 (plus $1.35 P&H). 1978.

The preface tells most of the story, "With the roots of the BASIC language now firmly established throughout the world, it is necessary to make its many dialects understandable so programs can be transported between different computers. After you've found just the program you've been looking for, you know how frustrating it is only to discover that it won't RUN on **your** computer. This HANDBOOK addresses that problem by discussing in detail every commonly used BASIC Statement, Function, Operator and Command."

Over 250 BASIC words, as used in more than 50 computers, are covered, each with a description, a test program and sample run using the word, variations in usage of the word, and a list of related words. Many words have a section on "If your computer doesn't have it," which "gives alternate ways to accomplish the same objective using other BASIC words, when possible ... and it isn't always possible." This is a great help when transcribing a program that uses, for example, MAT READ, SPC, STUFF, or some other word not included in your computer's set of words. This is the only book now available to help software fans convert "foreign" programs for use on their own computers.

○ ○ ○

The Little Book of BASIC Style, by John M. Nevison. Addison-Wesley Publishing Co., Reading, MA. 158 pages, paperback $4.95. 1978.

This first book in Addison-Wesley's Joy of Computing series is for anyone who wants to write better BASIC programs. The book offers rules of style that can reduce the time necessary to turn out legible, correct programs. The rules also offer an approach to structured programming.

After an introductory chapter, 19 rules are presented in the next three chapters, on typing, comment and code. Some of the rules are: space the symbols so the line may be easily read, distinguish comment from code, "title to tell," match variables

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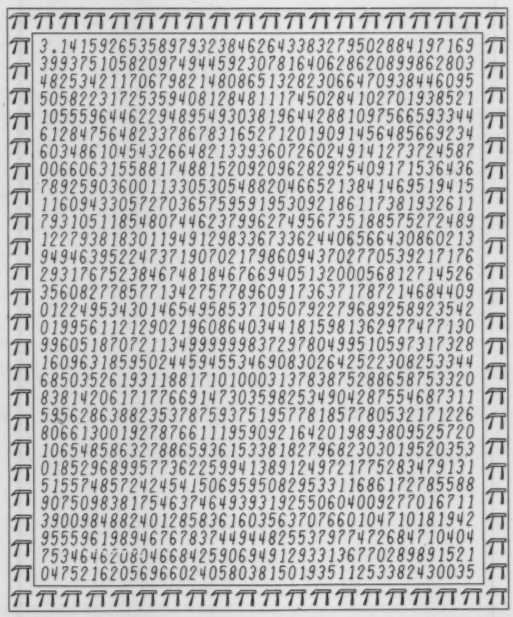

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to ideas, label constants, code top to bottom, and exit carefully. All are demonstrated with examples, both strong and weak.

Chapter 5 gives ten examples of The Program at Work and Play, following all the rules, with programs for craps, histograms, plots, etc.

The last chapter, Beyond BASIC: Larger Programs, presents a STYLIST program that indents structures in Minimal BASIC, with a dozen subroutines.

Even if this book improves your programs only a little, it's well worth the price, and requires only a minimum knowledge of BASIC.

Available from Creative Computing Book Service for $5.70 postpaid.

○ ○ ○

Getting Started With Your PET. Total Information Services, Box 921, Los Alamos, NM 87544. 53 pages, cardboard covers, $4.00. 1978.

The first of five workbooks by TIS, this beginner's text "supplements the documentation provided by Commodore."

The chapters cover Introduction, PET BASIC Calculator Mode, Inputting a Program, Getting Information Out of Your Program, Getting Information Into Your Program, Data Representation, and Using the Cassette for Program Storage. Coverage includes seven commands, nine statements, one function.

The text, called WB-1 for short, is full of detailed exercises that include the expected PET response. Each line the user enters is indicated by a T; each line of PET response is indicated by an R, as in this example (in calculator mode):

```
T:  L=ASC("Z")
T:  PRINT L, CHR$(L)
R:  90      Z
T:  L=ASC("ZXCV")
T:  ?L
R:  90
```

The originals are typed, the pages offset, in this inexpensive workbook that should be useful to a beginner needing help.

The other four workbooks are on PET String and Array Handling, PET Graphics, PET Cassette I/O, and Miscellaneous Features.

○ ○ ○

The 8080A Bugbook: Microcomputer Interfacing and Programming, by Peter R. Rony, David G. Larsen, and Jonathan A. Titus. Howard W. Sams & Co., Inc., 4300 West 62 St., Indianapolis, IN 46268. 416 pages, paperback $9.95. 1977.

Written for the 8080 user who has a knowledge of digital logic and operations, this book explains the fundamentals of interfacing and the associated I/O programming. It's a revised and expanded version of *Bugbook III: Microcomputer Interfacing Experiments Using the Mark 80 Microcomputer, an 8080 System*, marketed by E&L Instruments.

Experiments in the original Bugbook III have been either rewritten as examples, incorporated into the text, or eliminated. For this book, no hardware is needed.

The eight chapters deal with basic concepts, the 8080-based microcomputer, introduction to programming, generating a device-select pulse, clock cycles and timing loops, internal operation of the 8080 chip, input/output, with a last chapter on subroutines, interrupts, external flags and stacks. Appendixes cover references, the 8080A instruction set (58 pages), and a one-page summary of the 8080 instruction set.

The writing is clear, the text detailed and full of helpful examples, and well worth the money. Even if you never work up any interfaces, there's a great deal of very worthwhile information here, to help you understand the 8080A.

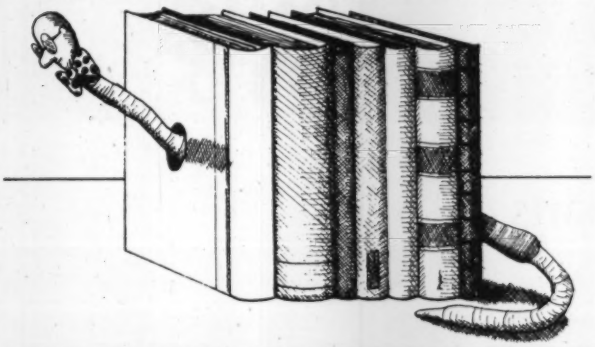
○ ○ ○

8080 Machine Language Programming for Beginners, by Ron Santore. Dilithium Press, 30 N.W. 23rd Place, Portland, OR 97210. 111 pages, paperback $6.95. 1978.

This may be the only slow-and-easy book on machine-language programming. It doesn't cover all 78 of the 8080 op-codes, which would take a much bigger book, but does give a very good grounding in the most common ones, about two dozen.

After a brief introduction, the author starts with a short program that displays an ASCII character repeatedly on the terminal, giving for each step the octal address, op-code and a short explanation. This is then repeated, with a *detailed* explanation for each of the 13 steps, covering two and a half pages. Each step is explained so completely and clearly that even a very young beginner should have little trouble following it.

The programs are covered in such detail that only six more are given: display a message, input a message to the terminal, generate a random number, Hi-Low game, Nim game, and Button-Button game. The rest of the book covers condition bits, defines most of the 8080 op-codes, gives three more programs (sum the numbers 0 to 10, roll of two dice, a better random-number generator), gives ASCII codes, and provides answers to the questions asked randomly in the book.



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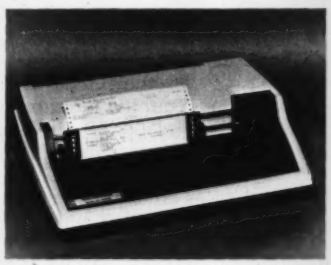

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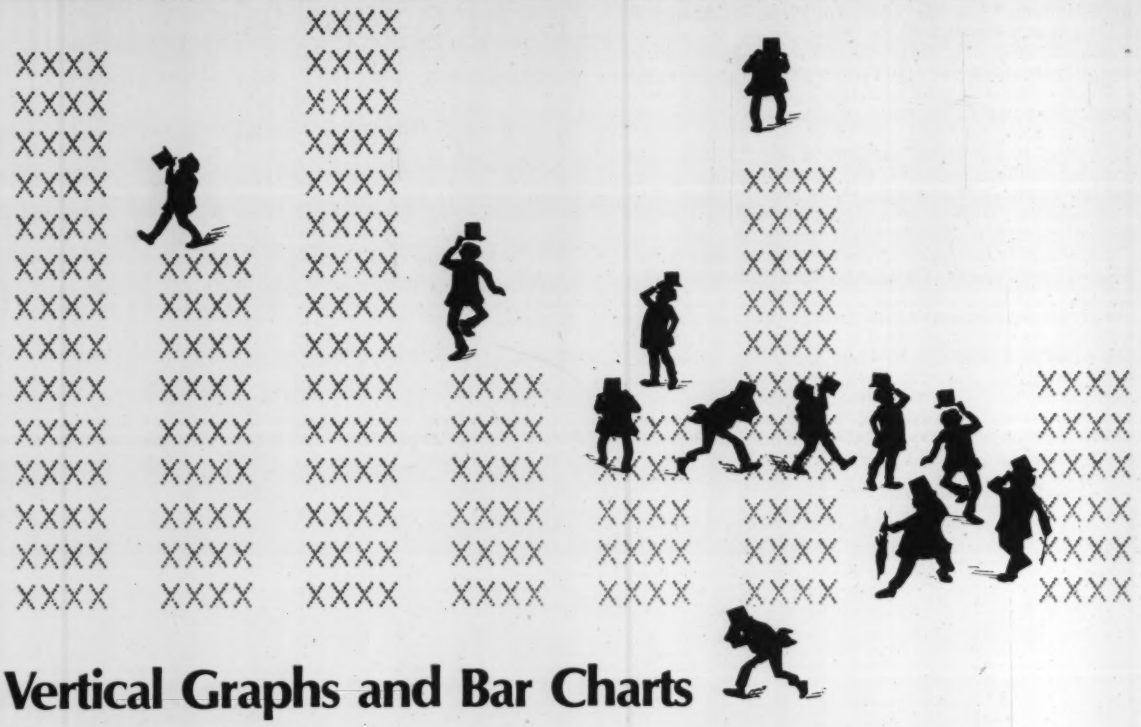


Vertical Graphs and Bar Charts

Robert P. Barrett

Computer graphing on standard terminals is often neck straining. Users grow tired of tilting their heads to view horizontal bars in their accustomed vertical mode. The following programs present a simple technique for vertical graphs and bar charts.

A matrix, a grid of numbers located through horizontal rows and vertical columns, is used to do the plotting. The program 'writes' the graph into the matrix in the traditional way using the rows for X values and the columns for height. The trick comes when the matrix is rotated for printing by using the columns as the carriage direction. The height is then in a vertical direction.

More specifically, the program readies the matrix for the graph by putting a zero in each location. The command Mat A = Zer, accomplishes this task. Next the program sets 1's into the matrix wherever printing is needed. This function is done by the command A(I,Y) = 1. The matrix now has a 1 on the Ith row, Y spaces out. To print a bar chart for the data 4,2,3, the matrix would appear as in Fig. 2. The graph of the equation Y= 2X + 1 for X = 1, 2, 3 would look like Fig. 3. Now the matrix is printed by letting the printing head trace down the columns, and print a space for each 0 and a "*" for each 1. Printing a bar chart requires 6 spaces for a 0 and "XXXX__" for a 1.

```
1 1 1 1 0 0
1 1 0 0 0 0
1 1 1 0 0 0
```

Fig. 2

```
1 0 0 0 0 0
0 0 1 0 0 0
0 0 0 0 1 0
```

Fig. 3

Graphs are best in standard sizes, so it is convenient to scale the data before setting it into the matrix. Scaling reduces or increases the data proportionally to a pre-determined number; in this program 15 is the height of the largest bar and 20 is the height of the graphs. No matter what the range of the data, scaling changes it to fit into the matrix. A Scaling Function, FNC(X), is used in which the data is divided by the maximum minus the minimum and multiplied by the standard height. The integer value is used after .5 is added to round off the data instead of just truncating the decimals.

This method is quite flexible because more than one function can be set into the matrix allowing graphing of two equations at once. Also, the X and Y axis can be graphed in their true position. The X axis is found by printing the function, Y = 0 with the symbol X. The Y axis is found from the inputted range of X.

To run the bar graph program, the user types in Data lines 3100 and 3200 so that the first entry is the number of bars to be plotted, the second number is zero, and the data follows. To run the single graphing program the user types in for line 300 the proper function to be graphed. If one wanted to graph $Y = 3X^3 - 2X$, one would type 300 DEF FNA(X) = 3*X 3 - 2*X. On run the computer requests the X range, and the user types two ascending values of X, e.g. 0,3. The computer then plots a graph of the function for these values of X. In the double graphing any two functions can be typed in for steps 300 and 400. By having control of the X range during the running of the program the user can look at any portion of the graph that interests him.

Program Language: Basic-X
Computer Used: Hewlett-Packard

Robert P. Barrett, Messiah College, Grantham, PA 17027

```
LIS
BARRETT1

0100  REM X AXIS IS L2 AND Y AXIS IS L1 SPACES
0200  READ L1,L2,M,S
0300  DEF FNA(X)=SIN(X/57.2)
0400  DEF FNC(X)=INT((X-M)/(S-M)*L1+1.5)
0500  DIM A[31,31]
0600  MAT A=ZER
0700  REM FIND MAX (S) AND MIN (M) FOR SCALING
0800  INPUT "PUT IN START AND FINISH VALUES OF X? ",A,B
0850  Y1=INT(-A/(B-A)*L2+1)
0900  D=(B-A)/L2
1000   FOR X=A TO B STEP D
1100   Y=FNA(X)
1200   IF S>Y THEN 1400
1300   S=Y
1400   IF M<Y THEN 1600
1500   M=Y
1600   NEXT X
1700  PRINT " Y MAX. = ";S
1800  REM  SETTING GRAPH INTO MATRIX
1900  I=0
2000  X1=FNC(0)
2100   FOR X=A TO B STEP D
2200   Y=FNC(FNA(X))
2300   I=I+1
2400   A[I,X1]=-1
2500   A[I,Y]=1
2600   NEXT X
2700  PRINT
2800   FOR I=L1+1 TO 1 STEP -1
2900   PRINT TAB(5);
3000    FOR J=1 TO L2+1
3100     IF A[J,I]=1 THEN 3700
3200     IF A[J,I]=-1 THEN 3500
3250     IF J <> Y1 THEN 3300
3260     PRINT "y";
3270     GOTO 3400
3300     PRINT " ";
3400     GOTO 3800
3500     PRINT "x";
3600     GOTO 3800
3700     PRINT "*";
3800     NEXT J
3900   PRINT
4000   NEXT I
4100  PRINT
4200  PRINT "   X = ";A;
4300  PRINT TAB(L2-2);"X = ";B
4400  PRINT "Y MIN. = ";M
4500  DATA 20,30,0,0
4600  END
```

Function Graphed

Scaling function.

Finding the maximum for scaling the graph.

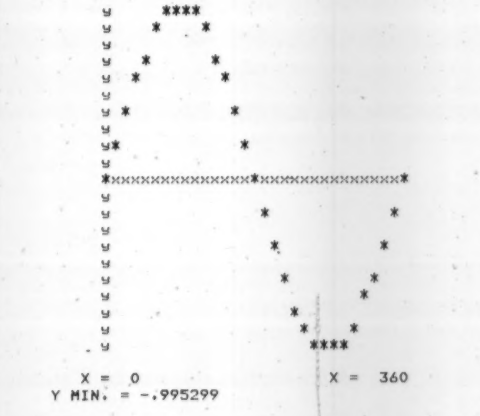
Putting the graph into the matrix
1 = graph point
-1 = X-axis

Printing out the matrix

Single Graph

```
RUN
BARRETT1

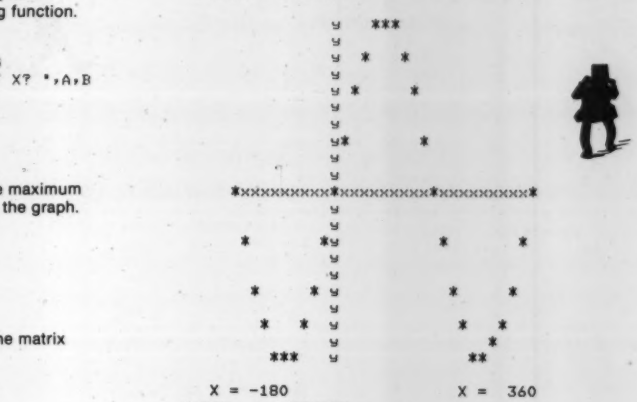
PUT IN START AND FINISH VALUES OF X? 0,360
 Y MAX. =  .994776
```



```
   X =  0                    X =  360
Y MIN. = -.995299
```

```
DONE
RUN
BARRETT1

PUT IN START AND FINISH VALUES OF X? -180,360
 Y MAX. =  .999996
```



```
   X = -180                  X =  360
Y MIN. = -.999997
```

BARRETT3

Double Graphing

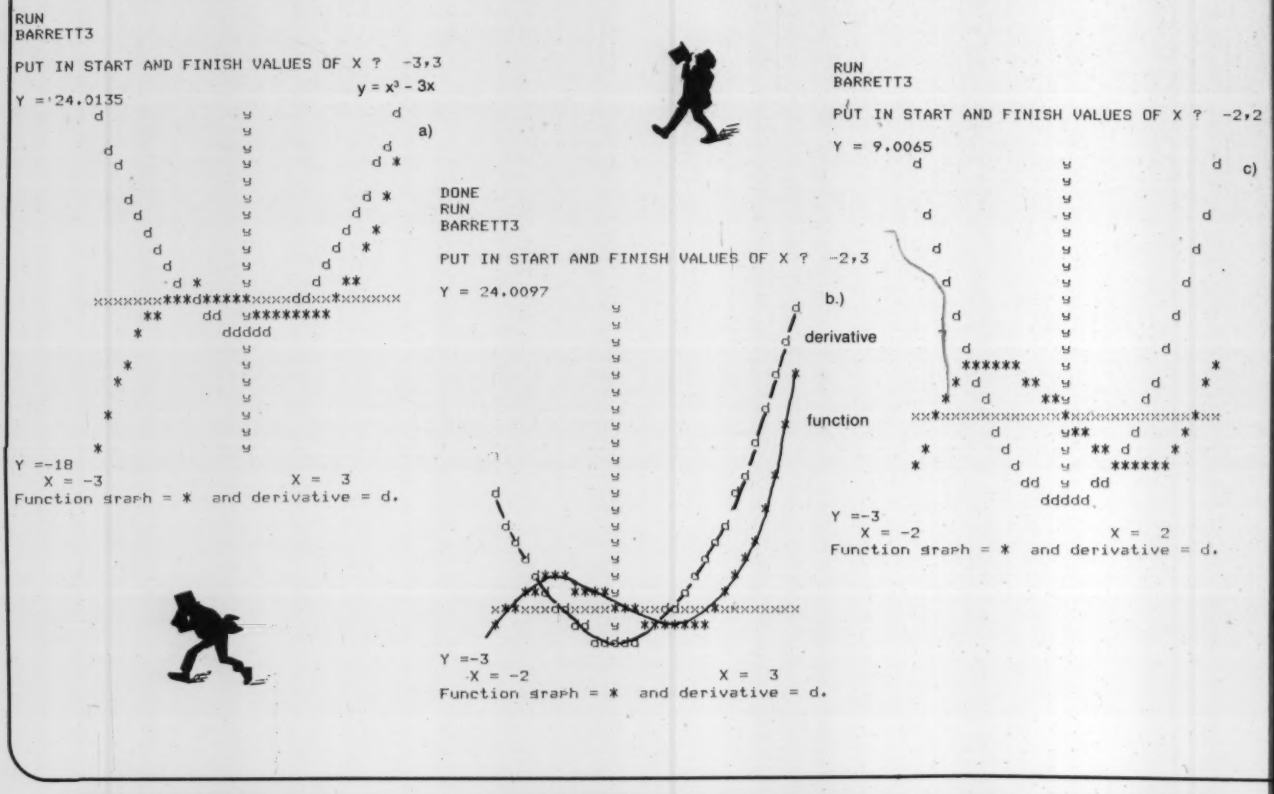
```
0100  REM X AXIS IS L2 AND Y AXIS IS L1 SPACES
0200  READ L2,L1,M,S
0300  DEF FNA(X)=X^3-3*X
0400  DEF FNB(X)=(FNA(X+.001)-FNA(X))/.001
0500  DEF FNC(X)=INT((X-M)/(S-M)*L1+1.5)
0600  DIM A[71,41]
0700  MAT A=ZER
0800  REM FIND MAX (S) AND MIN (M) FOR SCALING
0900  INPUT "PUT IN START AND FINISH VALUES OF X ?  ",A,B
1000  Y1=INT(-A/(B-A)*L2+1)
1100  D=(B-A)/L2
1200   FOR X=A TO B STEP D
1300   Y=FNA(X)
1400   Z=FNB(X)
1500   IF S>Y THEN 1700
1600   S=Y
1700   IF M<Y THEN 1900
1800   M=Y
1900   IF S>Z THEN 2100
2000   S=Z
2100   IF M<Z THEN 2300
2200   M=Z
2300   NEXT X
2400  PRINT
2500  PRINT "Y =";S;
2600  PRINT
2700  REM  SETTING GRAPH INTO MATRIX
2800  I=0
2900  X1=FNC(0)
3000   FOR X=A TO B STEP D
3100   Y=FNC(FNA(X))
3200   Z=FNC(FNB(X))
3300   I=I+1
3400   A[I,X1]=-1
3500   A[I,Z]=2
3600   A[I,Y]=1
3700   NEXT X
3800   FOR I=L1+1 TO 1 STEP -1
3900   PRINT TAB(8);
4000    FOR J=1 TO L2+1
4100    IF A[J,I]=1 THEN 5100
4200    IF A[J,I]=2 THEN 5300
4300    IF A[J,I]=-1 THEN 4900
4400    IF J <> Y1 THEN 4700
4500    PRINT "y";
4600    GOTO 4800
4700    PRINT " ";
4800    GOTO 5400
4900    PRINT "x";
5000    GOTO 5400
5100    PRINT "*";
5200    GOTO 5400
5300    PRINT "d";
5400    NEXT J
5500   PRINT
5600   NEXT I
5700  PRINT "Y =";.01*INT(100*M+.5)
5800  PRINT "   X = ";A;
5900  PRINT TAB(L2-2);"X = ";B
6000  PRINT "Function graph = *  and derivative = d."
6100  DATA 30,20,0,0
6200  END
```

Finding max, S, and min, M, for scaling

Printing out matrix

Legend
0 = space
1 = * Graph
2 = d 2nd Graph
-1 = X axis

function
2nd function
scaling



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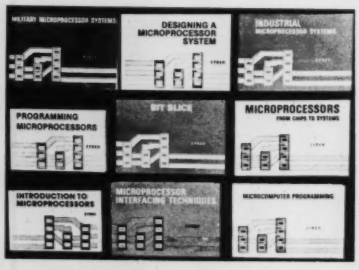

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CIRCLE 179 ON READER SERVICE CARD

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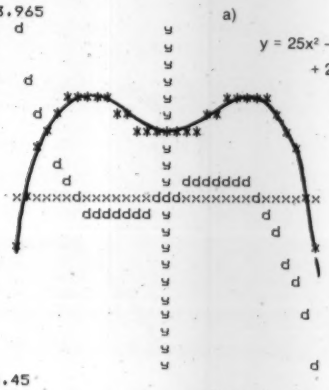
```
400 DEF FNS_A(X) = 25*X^2 - X^4 +200
RUN
BARRETT3

PUT IN START AND FINISH VALUES OF X ?  -6,6

Y = 563.965
```

a)




```
Y =-564.45
   X = -6                    X =  6
Function graph = *  and derivative = d.
```

```
400 DEF FNA(X) = COA_S(X)
RUN
BARRETT3

PUT IN START AND FINISH VALUES OF X ?  0,6.5      radians

Y = 1.
```

a.) y = cos x

```
Y =-1
   X =  0                    X =  6.5
Function graph = *  and derivative = d.
```

```
RUN
BARRETT3

PUT IN START AND FINISH VALUES OF X ?  -5,5

Y = 355.358
```

b.)

```
Y =-250.37
   X = -5                    X =  5
Function graph = *  and derivative = d.
```

```
6300 DATA 60,20,0,0          x axis extended to 60
RUN
BARRETT3

PUT IN START AND FINISH VALUES OF X ?  0,13      b.)

Y = 1.
```

```
Y =-1
   X =  0                                        X =  13
Function graph = *  and derivative = d.
```

```
RUN
BARRETT3

PUT IN START AND FINISH VALUES OF X ?  -5.5,0

Y = 390.503
```

c.)

```
Y =-67.99
   X = -5.5                  X =  0
Function graph = *  and derivative = d.
```

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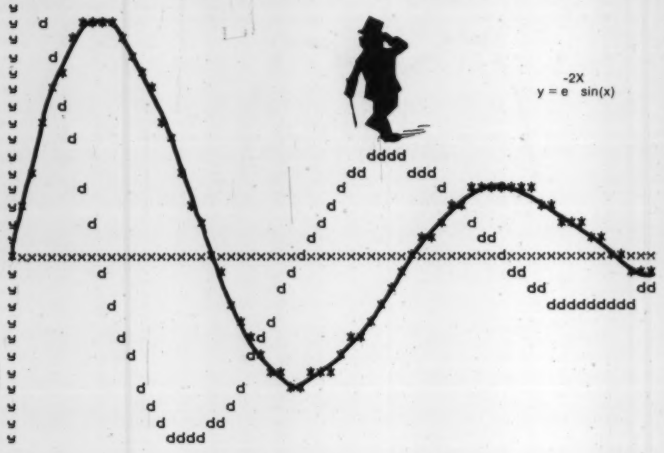
```
300 DEF FNA(X) = EXP(-K*X)*SIN(X)
290 K = .2
RUN
BARRETT3

PUT IN START AND FINISH VALUES OF X ?  0,10

Y = .9998
```




```
Y =-.58
   X =  0                                          X =  10
Function graph = *  and derivative = d.

DONE
```

```
0290  K=.2
0300  DEF FNA(X)=EXP(-K*X)*SIN(X)
0400  DEF FNB(X)=(FNA(X+.001)-FNA(X))/.001
0500  DEF FNC(X

ABORT
RUN
BARRETT3

PUT IN START AND FINISH VALUES OF X ?  0,15

Y = .9998
```

```
Y =-.58
   X =  0                                          X =  15
Function graph = *  and derivative = d.

DONE
```

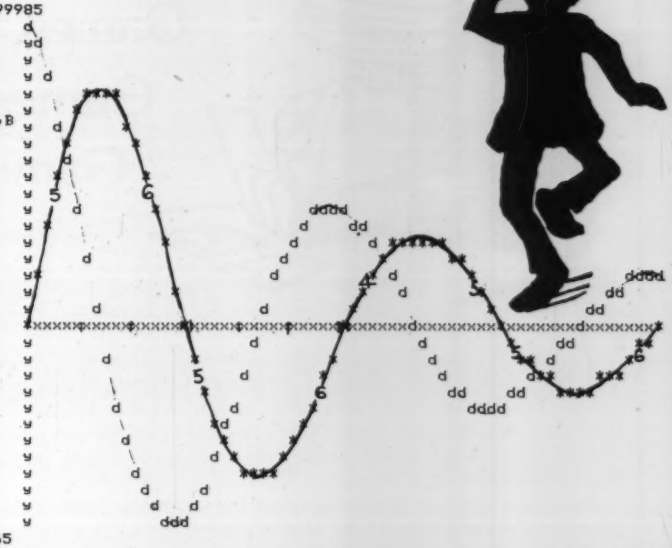
```
BARRETT4

0100 REM X AXIS IS L2 AND Y AXIS IS L1 SPACES
0200 READ L2,L1,M,S
0290 K=.15
0300 DEF FNA(X)=EXP(-K*X)*SIN(X)
0400 DEF FNB(X)=(FNA(X+.001)-FNA(X))/.001
0500 DEF FNC(X)=INT((X-M)/(S-M)*L1+1.5)
0600 DIM A[71,41]
0700 MAT A=ZER
0800 REM FIND MAX (S) AND MIN (M) FOR SCALING
0900 INPUT "PUT IN START AND FINISH VALUES OF X ? ";A,B
1000 Y1=INT(-A/(B-A)*L2+1)
1100 D=(B-A)/L2
1200  FOR X=A TO B STEP D
1300  Y=FNA(X)
1400  Z=FNB(X)
1500  IF S>Y THEN 1700
1600  S=Y
1700  IF M<Y THEN 1900
1800  M=Y
1900  IF S>Z THEN 2100
2000  S=Z
2100  IF M<Z THEN 2300
2200  M=Z
2300  NEXT X
2400 PRINT
2500 PRINT "Y =";S;
2600 PRINT
2700 REM  SETTING GRAPH INTO MATRIX
2800 I=0
2900 X1=FNC(0)
3000  FOR X=A TO B STEP D
3100  Y=FNC(FNA(X))
3200  Z=FNC(FNB(X))
3300  I=I+1
3400  A[I,X1]=-1
3500  A[I,Z]=2
3600  A[I,Y]=1
3700  NEXT X
3800  FOR I=L1+1 TO 1 STEP -1
3900  PRINT TAB(8);
4000   FOR J=1 TO L2+1
4100    IF A[J,I]=1 THEN 5100
4200    IF A[J,I]=2 THEN 5300
4300    IF A[J,I]=-1 THEN 4900
4400    IF J <> Y1 THEN 4700
4500    PRINT "y";
4600    GOTO 4800
4700    PRINT " ";
4800    GOTO 5400
4900    PRINT "x";
5000    GOTO 5400
5100    PRINT "*";
5200    GOTO 5400
5300    PRINT "d";
5400    NEXT J
5500  PRINT
5600  NEXT I
5700 PRINT "Y =";.01*INT(100*M+.5)
5800 PRINT "    X = ";A;
5900 PRINT TAB(L2-2);"X = ";B
6000 PRINT "Function graph = *  and derivative = d."
6100 DATA 64,30,0,0
6200 END
```

```
L_RUN
BARRETT4

PUT IN START AND FINISH VALUES OF X ?  0,12.5

Y = .99985
```



```
Y =-.65
   X =  0                                          X =  12.5
Function graph = *  and derivative = d.
```

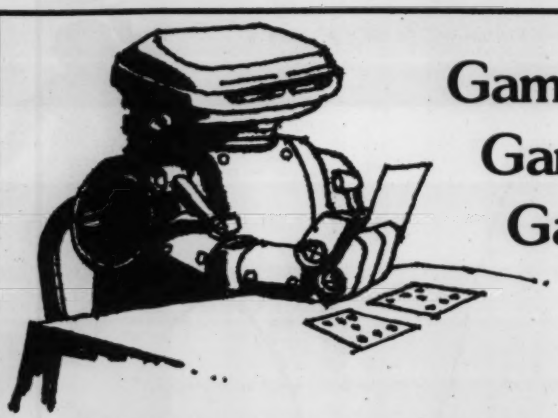
```
DONE
LIS
BARRETT6

0100  DIM A[26,16]
0200  DIM X[25]
0300  DEF FNC(X)=INT(X/S*15+.5)        scaling function
0400  MAT A=ZER
0500  READ N,S                         n = no. of bars (data)
0600   FOR I=1 TO N
0700   READ X[I]
0800   IF S>X[I] THEN 1000
0900   S=X[I]                          Finding the maximum, S
1000   NEXT I
1100   FOR I=1 TO N
1200   Y=FNC(X[I])
1300    FOR J=1 TO Y
1400    A[I,J]=1                       Setting the data as 1's into the matrix A
1500    NEXT J
1600   NEXT I
1700  PRINT S;
1800   FOR I=15 TO 1 STEP -1
1900   PRINT TAB(10);
2000    FOR J=1 TO N
2100    IF A[J,I]=1 THEN 2400
2200    PRINT "      ";                Printing out the matrix (Note J & I are switched in A
2300    GOTO 2500                      so that the carriage traces along the columns
2400    PRINT "XXXX  ";                starting at the right, 15, & going left.
2500    NEXT J
2600   PRINT
2700   NEXT I
2800  PRINT
2900  PRINT TAB(10);
3000  PRINT "ZOOK  JONES BOMB  FSTN  GOLD  MILT  TYRO  ROMB"
3100  DATA 8,3,450,300,480,200,150
3200  DATA 350,0,200
3300  END

RUN
.BARRETT6
 480
```

```
                    XXXX
          XXXX      XXXX
          XXXX      XXXX
          XXXX      XXXX
          XXXX      XXXX                XXXX
          XXXX      XXXX                XXXX
          XXXX  XXXX XXXX               XXXX
          XXXX  XXXX XXXX               XXXX
          XXXX  XXXX XXXX               XXXX
          XXXX  XXXX XXXX  XXXX         XXXX          XXXX
          XXXX  XXXX XXXX  XXXX  XXXX   XXXX          XXXX
          XXXX  XXXX XXXX  XXXX  XXXX   XXXX          XXXX
          XXXX  XXXX XXXX  XXXX  XXXX   XXXX          XXXX
          XXXX  XXXX XXXX  XXXX  XXXX   XXXX          XXXX
          XXXX  XXXX XXXX  XXXX  XXXX   XXXX          XXXX

          ZOOK  JONES BOMB  FSTN  GOLD  MILT  TYRO  ROMB
```



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(2) "A Tale of Greed". The first Arab was entitled to seven, and the second to one only of the eight coins For, the consumption being equal, each person ate 8/3 (2 2/3) loaves. Of the portion eaten by the stranger the first Arab contributed 2 1/3 loaves, while the second contributed 1/3 loaf. The former therefore contributed seven parts, while the second contributed one only, and the proper division of the money was seven coins to the first, and one to the second.

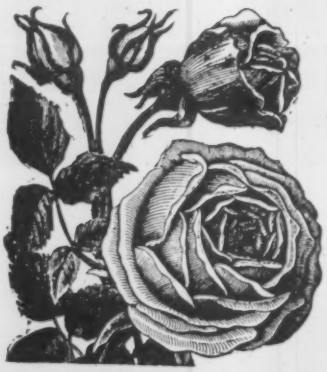
(3) "Alice in Puzzleland".

(4) "The Puzzle Generator". 75 Triangles.

(5) "A Banner Problem". This is a mere "sell". The answer is "Letters". In the word "twenty" there are six letters, in the word "six", three, and so on.

(6) "The Old Soup and Fish". SOUP, SOUR, POUR, POUT, POST, PAST, FAST, FIST, FISH.

(7) "A Weightly Matter". Seven weights are required, of 1, 2, 4, & 8, 16, 32 and 64 lbs. respectively, together making 127 lbs. It will be found that, by using one, two, or more of these, any weight from 1 to 127 lbs. can be weighed



INDEX TO ADVERTISERS

Reader Service No.	Advertiser	Page No.
102	ABS Software	47
199	Advanced Computer Products	51
103	AJA Software	42
200	Aladdin Automation	9
148	Apple Computer Company	7
105	Automated Business/ Programming Svcs.	46
110	Automated Simulations	36
157	Automated Resource Management	126
104-44	Berkeley Medical Data Assoc.	32,81
149	The Bottom Shelf	39
134	Cload Magazine	25
111	Computer Components	79
	Computer Consultants	143
112-20	Computer Enterprises	55
	Computer Factory	47
171	Computer Information Exchange	150
106	Computer Lab of NJ	89
154	Computer Mart	123
107	Computer Mart Systems	53
124	Computer Store of Santa Monica	71
119	Computer Systems Design	103
166-69	Connecticut MicroComputer	29,30,31,35
180	Cost Effective Computer Svcs.	46
	Creative Computing	64,65,90,91
114	Cromemco	1
101	Datasearch	82
	Digital Press	68,69
174	Electronic Systems	95
115	Escon	82
198	Exidy	43
116	Forethought Products	109
197	Frazer & Assoc.	137
153	Gaudeus Magazine	101
152	GRT	41
117	Hobby World Electronics	36
118	Holistic Data Systems	114
109	Ithaca Audio	12,13
126	JHM Marketing	129
156	Lee Mathews & Assoc.	107
	Lifeboat Assoc.	83
164	Ligori Data Svcs.	126
162	Mad Hatter Software	27
137	Marketline Systems	57
151	Math Application Svcs.	61
184	Meca	83
127	Micro-Ap	5
170	MicroComputer Devices	105
195	MicroComputer World	144
172	MicroMail	145
177	Micro Mike's	129
173	MicroProducts Unlimited	114
	MicroSoft	6
133	Midwest Scientific Instruments	21
176	Mini Micro Mart	115
145	Muse	183
	Naafexco Corp.	137
159-60	Netronics R&D Ltd.	48
161	Newman Computer Exchange	119
	NRI Schools—Electronics Division	33
146	Ohio Scientific	Cov. 4
188	OK Machine & Tool Co.	97
128	On Line	93
155	Percom Data	61
	Personal Computing Festival	113
191	Personal Programming Svcs.	46
108-40	Personal Software	Cov. 3,46,70,126
	The Pet Gazette	131
163	Plainsman MicroSystems	73
165	Practical Applications	57
	Produx 2000	111
	Program Design, Inc.	45
129	The Programming Shop	137
141	Pumphrey, William	137
135	Quality Software	136
123	Rainbow Computing	23
150	Realty Software	32
142	Reliance Plastics & Packaging	136
	Sam's Computer Books	19
186	SSI Publications	123
131	Seattle Computer Products	63
121	Small Systems Software	26
125	Smoke Signal Broadcasting	2
136	Software-80	77
139	Southwest Technical Products Corp.	Cov. 2
178-79	Sybex	84,148
30	Tarbell Electronics	143
138	Terminal Sales	93
143	Tiny-C	11
145	Thinker Toys	15
158	Trans-Net Corp.	103
189	Western Digital	10

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104	109	114	119	124	179	184	189	194	199
105	110	115	120	125	180	185	190	195	200
126	131	136	141	146	201	206	211	216	221
127	132	137	142	147	202	207	212	217	222
128	133	138	143	148	203	208	213	218	223
129	134	139	144	149	204	209	214	219	224
130	135	140	145	150	205	210	215	220	225
151	156	161	166	171	226	231	236	241	246
152	157	162	167	172	227	232	237	242	247
153	158	163	168	173	228	233	238	243	248
154	159	164	169	174	229	234	239	244	249
155	160	165	170	175	230	235	240	245	250
251	256	261	266	271	276	281	286	291	296
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126	131	136	141	146	201	206	211	216	221
127	132	137	142	147	202	207	212	217	222
128	133	138	143	148	203	208	213	218	223
129	134	139	144	149	204	209	214	219	224
130	135	140	145	150	205	210	215	220	225
151	156	161	166	171	226	231	236	241	246
152	157	162	167	172	227	232	237	242	247
153	158	163	168	173	228	233	238	243	248
154	159	164	169	174	229	234	239	244	249
155	160	165	170	175	230	235	240	245	250
251	256	261	266	271	276	281	286	291	296
252	257	262	267	272	277	282	287	292	297
253	258	263	268	273	278	283	288	293	298
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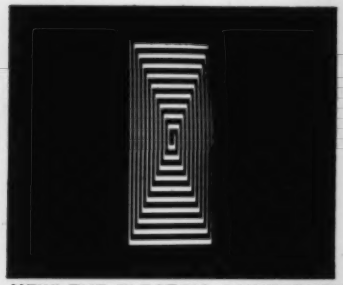

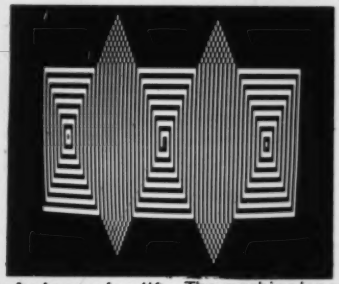

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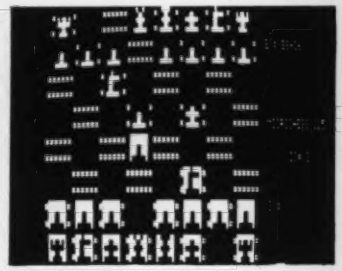

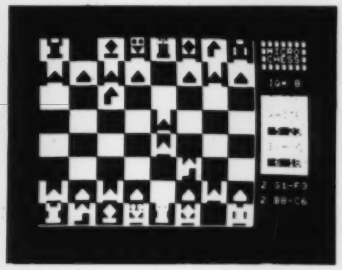

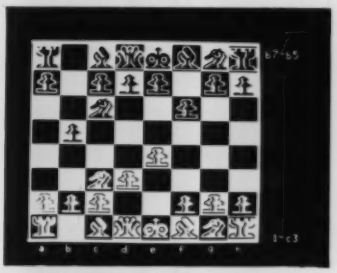

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